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Data Elements for Workload Analysis of Armored Vehicle Crews

Raymond C. Sidorsky

U.S. Army Research Institute

Manned Systems Group
John L. Miles, Jr., Chief

Systems Research Laboratory
Robin L. Keesee, Director

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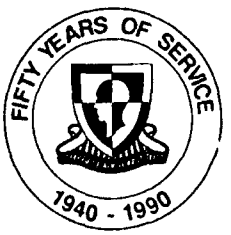

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The Task Analysis and Workload (TAWL) methods developed by the U.S. Army Research Institute Aviation Research and Development Activity (ARIARDA) for helicopter workload analysis was used as a model to develop AVTAWL (Armored Vehicle Task Analysis and Workload) methods for the analysis of workload for armored crews. An exhaustive search of relevant documentation was performed to identify all workload elements related to armored operations. The data elements identified in this paper provide a comprehensive vocabulary for interrogating personnel who are subject matter experts (SMEs) in armored operations. Such interrogation of SMEs would comprise the inputs to the AVTAWL software program and provide system developers with an operational M1 tank baseline for predicting the workload impact of various vehicles included in the Armored Systems Modernization program.

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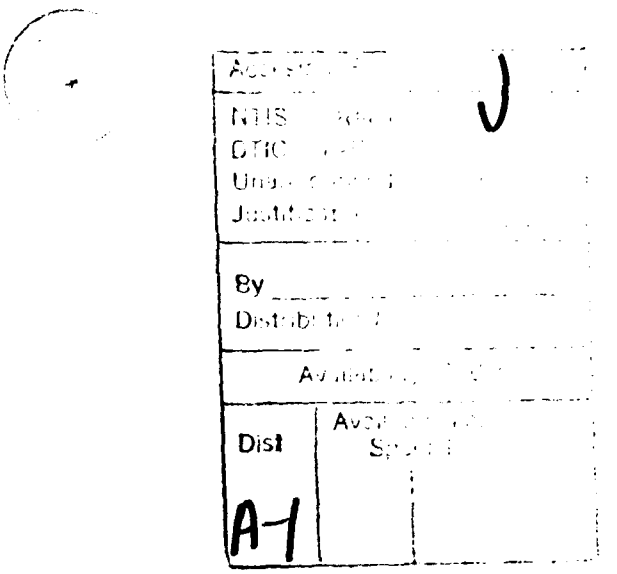
EDGAR M. JOHNSON
Technical Director

JON W. BLADES
COL, IN
Commanding

Technical review by

John L. Miles, Jr.



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FOREWORD

The Systems Research Laboratory of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) supports the Army with research and development on manpower, personnel, training, and human performance issues as they affect the development, acquisition, and operational performance of Army systems and the combat readiness and effectiveness of Army units. One concern that underlies all of these issues is the mental workload experienced by the operators of newly emerging, high technology systems, and the impact of that workload on operator and system performance.

Recently, the U.S. ARI Aviation Research and Development Activity (ARIARDA) at Fort Rucker, Alabama, developed a methodology for predicting operator workload during the concept development phase of the system development process for the Army's Light Helicopter Family (LHX) aircraft. This Task Analysis and Workload (TAWL) methodology employs a generic workload prediction model that can easily be tailored for use in making critical design decisions about emerging weapon systems.

In this paper the TAWL methodology was used to establish a database of information for developing models to (1) assess the workload of crews of the M1 family of tanks in various operational scenarios, and (2) predict the workload impact of various configurations of projected Armored Systems Modernization (ASM) vehicles.

EDGAR M. JOHNSON
Technical Director

DATA ELEMENTS FOR WORKLOAD ANALYSIS OF ARMORED VEHICLE CREWS

EXECUTIVE SUMMARY

Requirement:

The assessment and prediction of the mental and physical workload of the crews of future armored vehicles is a significant MANPRINT concern in the material acquisition process of the Armored Systems Modernization (ASM) program. The issue of crew workload is relevant to all six MANPRINT domains--manpower, personnel, training, human factors engineering, safety, and health hazards. A methodology for identifying and measuring the components of the workload of armored crews is urgently needed.

Procedure:

The TAWL methodology developed by the ARI Aviation Research and Development Activity (ARIARDA) for helicopter workload analysis was used as a model to develop the AVTAWL methodology for the analysis of workload for armored vehicle crews. Information sources for the AVTAWL (Armored Vehicle Task Analysis and Workload) technique included training manuals (TMs) for the M1 tank, field manuals (FMs) for armored operations, and documentation produced by ARIARDA related to the TAWL (Task Analysis and Work Load) methodology. An exhaustive review of these documents was performed to identify all workload elements related to armored operations.

Findings:

The TAWL methodology provided an effective model for the development of procedures for assessing and predicting the mental and physical workload of armored vehicles crew members. As with TAWL, the AVTAWL process centers around a detailed "timeline" analysis of a crew member's activities during a tactical operation. The tasks required to accomplish a mission are identified, along with data regarding their frequency, duration, and sequencing. Decision rules programmed in a digital computer are applied to these data to obtain an estimate of the workload of each crew member at each one-half second interval during the tactical operation. Application of the AVTAWL-TAWL procedure produces three outputs (1) identification of overload conditions, i.e., periods when one or more operator overloads has occurred,

(2) overload density, i.e., the percentage of time that an overload has occurred within a mission segment, and (3) subsystem overloads, i.e., the number of times that a subsystem is associated with an operator overload.

Utilization of Findings:

The data elements identified in this paper provide a comprehensive vocabulary for interrogating personnel who are subject matter experts (SMEs) in armored operations. Such interrogation of SMEs would comprise the inputs to the AVTAWL software program and provide system developers with an operational M1 baseline for predicting the workload impact of alternative design and operating features of the various ASM vehicles. Due to lack of funding, projected SME interrogations and subsequent workload analysis were not performed.

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INTRODUCTION

The purpose of this paper is to document the data elements and data collection worksheets devised to implement the AVTAWL technique of workload analysis. AVTAWL (Armored Vehicle Task Analysis and WorkLoad) is an extension of the TAWL methodology originated by the ARI Aviation Research and Development Activity (ARIARDA), the ARI Field Unit at Fort Rucker, AL. The TAWL methodology is sometimes referred to as the McCracken-Aldrich technique after J. McCracken of ARI and T. Aldrich of Anacapa Sciences, Inc., who originated the technique in order to analyze the workload of crews flying the LHX helicopter (McCracken and Aldrich, 1984).

The major objective in developing the AVTAWL model was to provide the PEO-ASM (Program Executive Office-Armored Systems Modernization) with a MANPRINT-oriented database and method for predicting the workload of crews of armored vehicles projected for acquisition in the ASM program.

Workload Analysis and MANPRINT

MANPRINT is an initiative recently undertaken by the Army to ensure that soldier-related factors are fully considered in the design of weapon systems. The basic thrust of MANPRINT is to ensure a positive answer to the question--Can this soldier, with this training, perform these tasks to these standards under these conditions? Guidance for implementing MANPRINT is contained in Army Regulation (AR) 602.2, Manpower and Personnel Integration (MANPRINT) in the Material Acquisition Process (Dept. Army, 1987) AR 602.2 requires consideration of data regarding crew member characteristics and performance in six distinct but interrelated domains--manpower, personnel, training, human factors engineering, safety, and health hazards.

The issue of operator workload is relevant to design trade-offs in all six MANPRINT domains. For example, reducing the size of a crew from 4 to 3 saves manpower but has an obvious impact on the workload of the smaller crew. New electronic sensors may increase the range, sensitivity, or precision of target acquisition data but may also increase the mental demands on the operator. This would require combat developers and system designers to consider the cost-benefit values of various trade-offs between soldier quality (as reflected in ASVAB scores, for example) and the full utilization of hardware capabilities. Specialized training is often a feasible method to reduce the effects of mental overload, but the cost of the specialized training devices and sustainment training may outweigh the probable effects of momentary overload on the accomplishment of the tactical mission.

A requirement to consider operator workload issues during all stages of the material acquisition process has been established by AR 602-1, Human Factors Engineering Program (Dept. Army, 1983). This regulation specifies a Human Factors Engineering (HFE) program shall be initiated for each weapon system in accordance with MIL-H-46855B, Military Specification: Human Engineering Requirements for Military Systems, Equipment and Facilities Dept. Army, 1979). Section 3.2.1.3.3 of MIL-H-46855B requires that individual and crew workload analyses shall be performed and compared with performance data. However, no guidance is provided to system developers as to how such a workload should be performed. (Bulger, Hill, & Christ, 1989). This project was undertaken in an effort to supply some of the information needed to develop and implement such guidance

Operator Workload Defined

The concern here is with "operator" work load. Operator workload refers to mental and physical work performed while interacting with a dynamically changing environment, e.g., operating a weapon system in a combat environment. It is distinguished from the mental or physical work performed while interacting with a static environment; for example, by a maintainer repairing an engine. Two types of effort are involved in operator workload; 1) obtaining information about the environment (e.g., weapon status, terrain, enemy, etc.) and 2) managing the operation of the various mental processes through which the operator interacts with the environment.

Report Content and Technical Approach

Using the TAWL methodology as a model, this report provides lists of definitions for verbs and objects involved in the analysis of operator workload associated with armored operations, descriptions of devices and equipments comprising the workstations in M1 (Abrams) tanks, functions and task performed by armor crews, and the worksheets needed to record the pertinent data.

Information sources for the construction of the AVTAWL model included training manuals (TMs) for the M1 tank, field manuals (FMs) for armored operations, and documentation produced by ARI-ARDA related to the TAWL methodology (See Bibliography, p. 69). An exhaustive review of these documents was performed to identify all workload related data elements in order to establish a comprehensive vocabulary for interrogating personnel who are subject matter experts (SMEs) in armored operation. The interrogation of the SMEs would comprise the inputs to the AVTAWL software program and provide a baseline for predicting the workload impact of alternative design and operating features of the various ASM vehicles. However, due to lack of funding, interrogation of the SMEs and the subsequent workload analysis of M1 crews were not performed.

The AVTAWL Model

The objective of AVTAWL and TAWL is to produce a model for predicting the mental workload of weapons system crews while operating the system. They involve two basic processes, (1) a comprehensive task analysis of the combat missions of the weapon system and (2) a detailed moment by moment analysis of the mental workload of each crew member during an operational segment. Two design goals of McCracken and Aldrich devising TAWL were to provide a technique that; (1) would enable rapid completion of workload prediction models and (2) would be applicable to systems in the concept stage and well as fielded systems.

In the AVTAWL-TAWL approach, the components of mental work load consist of activities in the five distinct channels through which the operator interacts with the environment, viz., the visual, auditory, sensory, psychomotor, and kinesthetic channels. The visual components include such actions as scanning, searching, reading, and tracking. The auditory components include such actions as detecting, discriminating, and understanding. The cognitive components include such operations as planning, calculating, deciding, and remembering. The psychomotor components (hereafter referred to as "muscular" components) include such actions as pushing, pulling, rotating, and speaking. The kinesthetic (or "feel") components include such operations as detecting or judging pressure, resistance, orientation, and movement.

Estimates of workload are obtained from subject matter experts (SMEs) who rate the tasks on a seven point scale. The SMEs are provided with verbal descriptions which serve as anchor points for each of the seven levels of workload. For example, the anchor points for the Visual Scale range from "monitoring" (scale value = 1) to "decipher text" (scale value = 7). Since the verbal anchor for the scale value 7 represents the highest possible workload for each of the five components, workload values greater than 7 imposed on any one channel creates an overload condition. Workload values are computed separately for each channel or component.

The AVTAWL process centers around a detailed "timeline" analysis of a crew member's activities during a tactical operation. The tasks required to accomplish a mission are identified along with data regarding their frequency, duration, and sequencing. Decision rules programmed in a digital computer (Bierbaum & Hamilton, 1989) are applied to these data to obtain an estimate of the mental workload of each crew member at each one-half second interval during the tactical operation.

Application of the AVTAWL-TAWL methodology produces three outputs; (1) identification of overload conditions, i.e, periods when one or more operator overloads has occurred, (2) overload density, i.e., the percentage of time that an overload has occurred within a mission segment, and (3) subsystem overloads, i.e., the number of times that a subsystem is associated with an operator overload.

The AVTAWL Process

As with TAWL, the AVTAWL process proceeds in three stages. In the first Stage (Task Analysis), the analyst's first job is to perform a top-down decomposition of the use of the system (see Figure 1). At the top level of analysis, each unique type of tactical operation is termed a "mission". After the mission is specified, the top-down analysis continues with the separation of the mission into divisions called "phases". The mission phases are further analyzed and divided into subparts called "segments". The segment level is the highest level directly simulated by AVTAWL.

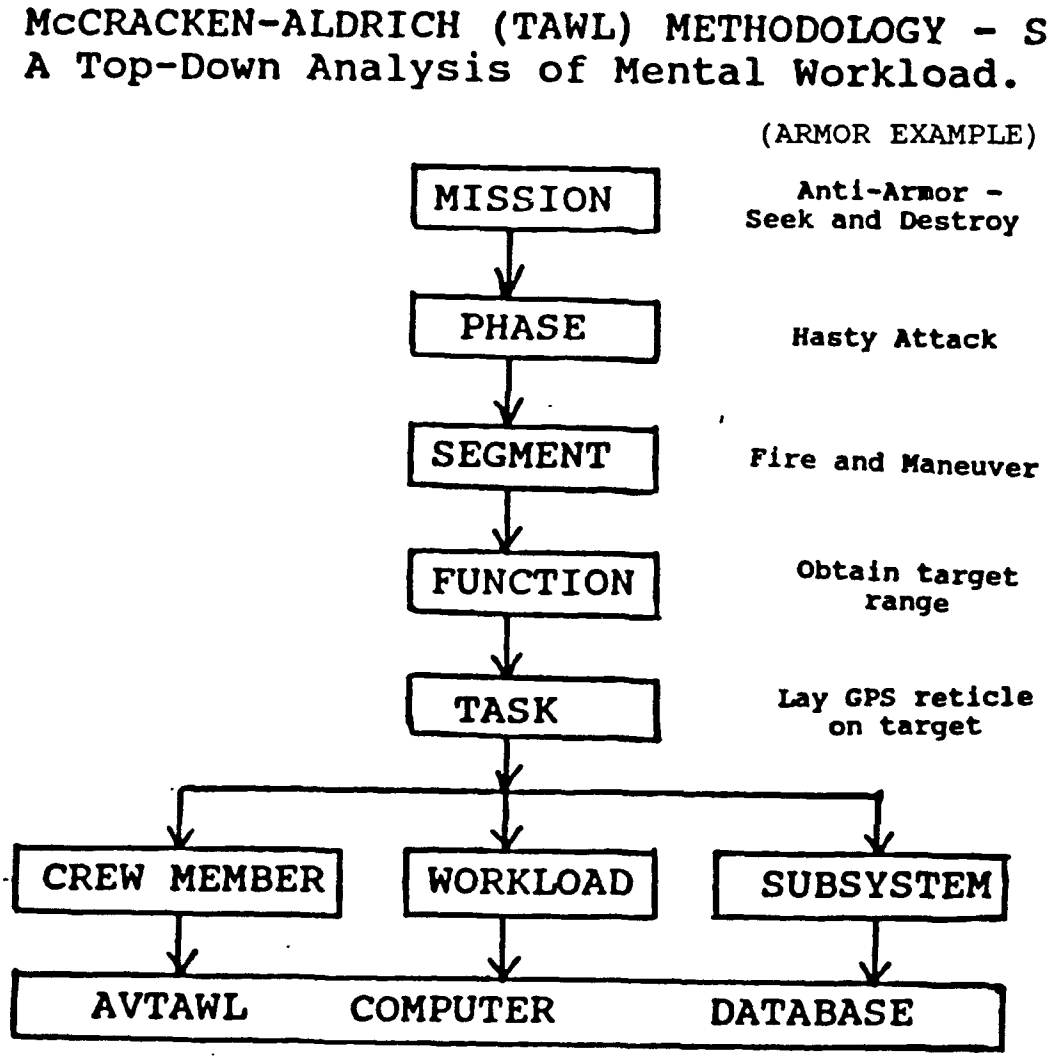

Figure 1. Top-Down Task Analysis Process Used in AVTAWL-TAWL

The next step in the top-down decomposition process of Stage 1 is to identify all of the subparts of the segments called "functions". Functions represent all crewmembers' actions necessary to carry out a single logical activity. The lowest level of mission decomposition is the "task". Tasks are defined as the non-interruptible crew activities that are essential to the successful completion of the function. Each task is described by a verb and and object. The verb describes the crewmember's action and the object describes the receipient of the action.

In order to identify the subsystems most associated with high workload, the subsystem associated with each task is also entered into the computer database. This allows each overload condition to be associated with a particular subsystem during the workload simulation.

In the second stage of the AVTAWL-TAWL methodology, Development of Decision Rules, the decision rules which specify how the tasks are dynamically combined to form functions and segments are developed. First, function decision rules are developed for combining the tasks into functions. Segment decision rules are then develped to combine the functions into segments. The function and segment decision rules reconstruct the mission to simulate the behavior of each crewmember at each point on the mission timeline.

Stage 3, Computer Simulation, involves execution of the decision rules and simulation of the crewmembers' actions during the operation of the system. This procedure produces estimates of each crewmember's workload by summing the component workload for each task that the crewmember is currently performing. Thus, the effect on operator workload of various system changes can be investigated by developing two models, one for the existing system and one with system modifications, and comparing the workload predictions.

Contextual Scenario

In order to provide a realistic context for evaluating the completeness of the AVTAWL data sources and data collection worksheets, a scenario of a representative armored combat operation was devised. A Hasty Attack operation was used as the basis for this scenario. A graphic illustration of this scenario is shown in Figure 2.

Hasty Attack Scenario Description

Key Player

Platoon Leader (PL), 1st Platoon, Company A, 37th Arm.

General Situation

Company A is in a rear assembly area and has just been alerted by the company CO to get ready to move to a forward assembly area.

At the forward assembly area the company CO issues the following operation order. "The 327 MRD (motorized rifle division) occupies a position west of GREEN river. Mounted recon patrols have been observed operating up to 15 kilometers west of that river. Enemy helicopters have been observed intermittently in the area. Company B will be moving parallel to us along H6 N6, about 5000 meters to our left. Company A will cross the SP (Start Point) at 0800 hours in a column of platoon, pass through the 3d Cav screen, conduct a movement to contact east along Hy N4, secure Hill 609, and then support following units crossing the GREEN River."

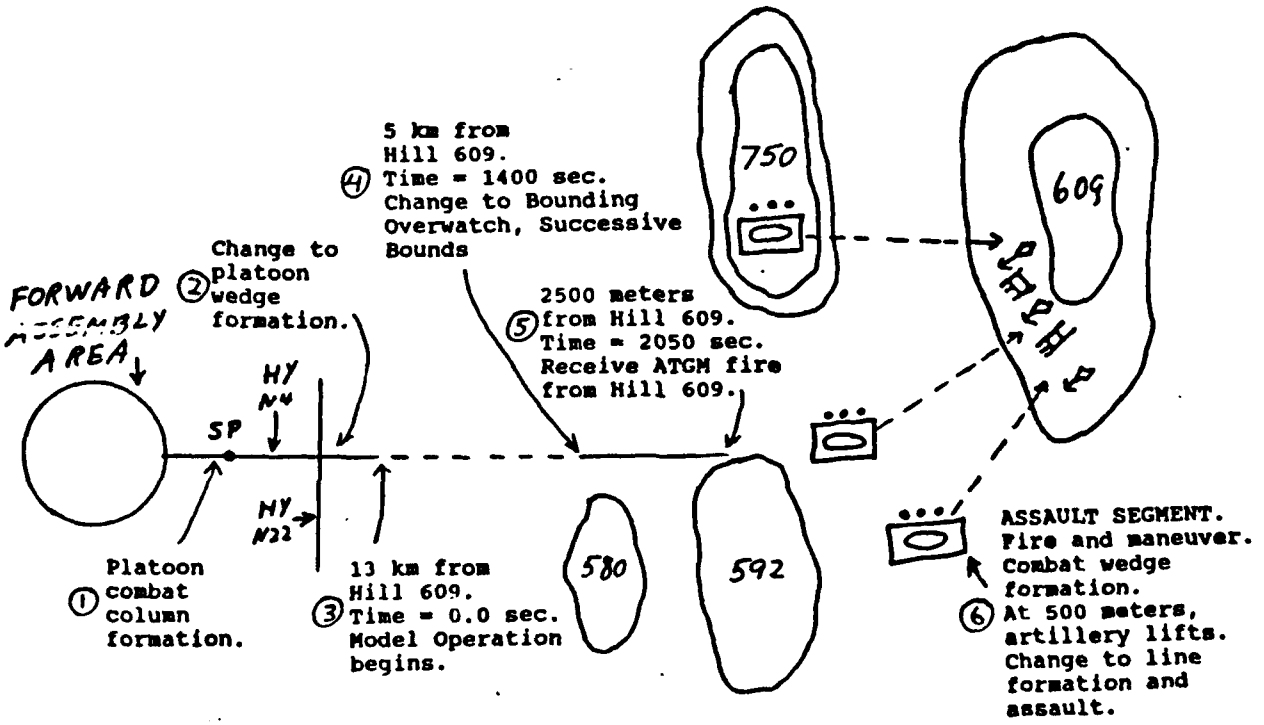

Figure 2. Graphic Illustration of Hasty Attack Scenario

1st Platoon Leader's Initial Operation Order

"We will be leading the company, column formation from the assembly area through the 3d Cav screen, then combat column to RJ N4-N22, then wedge formation. Logistics SOP. Current CEOI in effect, red star cluster emergemcy lifting of supporting fire, radio silence once we cross SP."

Movement to Contact

Five kilometers short of Hill 609 the platoon leader signals the platoon to change formation to a combat column and to continue the movement by using bounding overwatch by section, successive bounds movement technique. 2500 meters short of Hill 609 the lead (Platoon Leader's) section is fired upon by an ATGM from Hill 609. The lead section immediately goes into defilade while the second (Platoon Sergeant's) section engages the ATGM firing position. Upon reaching defilade, the platoon leader orders the #4 tank TC to call for indirect fire on enemy positions on Hill 609 while he makes as estimate of the situation and reports to the company CO. The PL reports that there appears to be 3 BMPs and at least two T-72s on Hill 609. Also, the platoon's fire doesn't appear to be very effective because of the long range and the location of the enemy targets.

Company Frag(mentary) Orders

The company CO is aware that Hill 609 is his objective and that it must be taken quickly in order for him to support a hasty river crossing by following units. He orders the FIST (fire support team) to smoke Hill 609. He also orders the 3rd Platoon to occupy hill 750 when Hill 609 has been smoked and to support the company's attack on Hill 609 by fire from Hill 750. Next he orders the 2nd Platoon to join him at the rear of Hill 580.

At Hill 580, the company CO issues the following frag order; "FIST you will place continuous fire of enemy positions on Hill 609. When we are within 500 meters of it lift your fires. 3d Platoon support by fire until our movement masks yous guns, then orient to the left of Hill 609 to cover our left flank. 1st and 2nd Platoons will attack, 1st Platoon is the base platoon and on the right. I'll be to the rear of the base platoon; Ex O will be on Hill 592, keeping a watch on our right flank. We move out as soon as the artillery hits the objective. Any Questions?"

Hasty Attack by 1st Platoon

The 1st Platoon moves out into the attack in a wedge formation and upon receiving direct fire conducts fire and maneuver. Upon reaching the assault position, the platoon changes to a line formation.

AVTAWL VERB LIST AND DEFINITIONS

ACCELERATE	- To increase speed.
ACCESS	- To gain visibility of or the ability to manipulate; to cause to be displayed.
ACKNOWLEDGE	- to indicate that information has been received and understood.
ACQUIRE	- To gain controlled observation of an object; to gain completely; to capture.
ACTIVATE	- To make operative; to put in active status.
ADDRESS	- To direct a report to the intended receiver.
ADJUST	- To change or correct so as to fit; conform; make suitable; make accurate.
ADVISE	- To give information or notice to.
AIM	- To point a weapon, sensor, etc. at a target.
ALERT	- To call anothers attention to an event or condition.
ALIGN	- To bring into a straight line.
ANALYZE	- To examine and interpret information.
ANNOTATE	- To add explanatory information to a text or graphic display of information.
APPROACH	- To come closer or nearer. To move along a path bringing the vehicle nearer to a target area, rendezvous area, etc.
ARM	- To make ready the parts needed for operation.
ASCERTAIN	- To find out with certainty via deliberate investigation.
ASSESS	- To estimate or determine the significance, importance, or value of; to evaluate.
ASSIGN	- To give out as a task or responsibility.
ASSIST	- To provide support or help; to aid
ASSAULT	- To delivery fires while moving rapidly toward a target(s).

AUTHENTICATE - To prove or serve to prove the authenticity of.

BRIEF - To supply with all the pertinent instructions or information.

CALCULATE - To determine by arithmetic processes.

CALIBRATE - To determine accuracy, deviation, or variation by measurement or comparison with a standard.

CHANGE - To substitute; to make different; to replace with or transfer to another of a similar kind.

CHECK - Examine to determine if something is as it should be.

CLASSIFY - To assign to a group or class according to some feature or aspect.

CLEAN - To wash, scrub, or apply solvents to; remove dirt, corrosion, or grease.

CLEAR - To pass without contact; to visually check that path is free of obstacles; to open up or free up a display.

CLOSE - To block against entry or passage; to set a circuit breaker to allow current flow.

COMMUNICATE - Transmit and receive information by radio or visual signals.

COMPLETE - Bring to a conclusion; end; finish.

CONTROL - To regulate in a prescribed manner or within safe or prescribed limits, especially in regards to movements.

COPY - To transcribe an aural message to a written memo. To duplicate

COORDINATE - To bring into a common action, movement, or condition.

CORRECT - To make right; to make an adjustment so as to compensate for an error or a counteracting force.

DEACTIVATE - To place in a non-active status, render inoperative.

DE-ARM - To make safe; to render inoperative

DECELERATE - To slow down.

DECIDE - To specify a course of action or a selection.

DEFINE - To mark or fix the limits of; to articulate the essential meaning or qualities of.

DELETE - To cause to no longer exist; remove

DEPART - To move away from an area.

DESCRIBE - To represent or give an account of in words.

DESIGNATE - To point out; mark out; indicate or specify.

DESTROY - To demolish or put out of existence; to make unfit for further use.

DETECT - To discover or determine the existence or presence of an object or condition.

DETERMINE - To reach a decision about something after thought and investigation; to find out exactly; calculate precisely; ascertain; resolve.

DEVISE - To think out, contrive, or plan a process or procedure for carrying out a tactical action.

DICTATE - To speak aloud into a recorder.

DIRECT - To manage the action of; to guide; to order or command with authority.

DISCONNECT - To break or undo the connection of; separate; detach; unplug.

DISCRIMINATE - To distinguish or differentiate by discerning exposing differences.

DISENGAGE - To cease contact with; to release or set free

DISTINGUISH - To perceive or show a difference in.

DISTRIBUTE - To allocate among recipients

DRIVE - To direct the movement and course of a vehicle.

ELEVATE - To increase the vertical angle of an object; to raise or lift up.

ENGAGE - To enter into conflict; to cause to interlock or mesh.

ENTER - To put into; insert; to go or come into.

ESTIMATE - To judge or determine generally but carefully; calculate approximately.

EVADE - To escape from observation or fire.

EVALUATE - To judge or determine the quality of.

EXECUTE - To follow out or carry out; do; perform; fulfill.

EXTRACT - To draw out or pull out by effort; remove

FIRE - To discharge a weapon.

FOCUS - To adjust the focal distance of the eye, a lens, etc. in order to produce a clear image.

FOLLOW - To direct ones course to approximate the course taken by a leading element or designated route.

FORD - To walk or drive across a stream or river.

GRASP - To take hold firmly with the hand.

HANDOFF - To transfer target information from a scout to an attack vehicle or from one attack vehicle to another attack vehicle.

HOLD - To maintain a steady state or condition, to grasp continuously.

IDENTIFY - To establish the identity of; to determine the classification of.

INFORM - To make known to; give notice or report the occurrence of.

INPUT - To enter information into a computer or other data system.

INSERT - To put or thrust in, into, or through.

INTEGRATE - To bring together information from two or more different sources for the purpose of combined analysis or presentation.

INTERCEPT - To stop or interrupt the progress or course of.

INTERPRET - To analyze or explain the meaning or significance of.

INVESTIGATE - To observe or study by close examination and systematic study.

JOIN UP - To come into proximity with other elements of a team, such as tanks in formation,

LASE - To direct a laser beam at an object.

LAY - To align the muzzle of a gun on a line with a target.

LEAD - To aim a gun just ahead of a moving target to account for the time for the round to reach the target's projected location.

LIFT - To cause to move from a lower to a higher position.

LIST - To enumerate in a written form.

LISTEN - To attend to auditory stimuli.

LOAD - To put a charge of ammunition into a weapon; to place in or on.

LOCATE - To discover the position of after a search.

LOCK-ON - To track and automatically follow a target, as by radar or other sensor.

LOG - To record for purposes of keeping records.

LOG-ON - To take action to gain access to a computer or communication network.

LOG-OFF - To relinquish access to a computer or communication network.

MAINTAIN - To keep in a certain condition or position of movement.

MANEUVER - To change the movement of a vehicle according to a specific pattern or series of movements.

MASK - To move to a position where the vehicle (or a part of it, e.g., turret, hull) will be below the light of sight (LOS) of enemy observers.

MONITOR - To casually attend to a source (e.g., a display) of possible sensory events or changes.

MOVE - To change place or position.

NAVIGATE - To establish and control the course of a vehicle in moving to a destination.

NEUTRALIZE - To destroy the effectiveness of; to nullify.

NOTE - To play close attention to.

NOTIFY - To make known to; to give notice or report the occurrence of.

OBSCURE - To conceal from view; make less conspicuous.

OBSERVE - To actively and purposely attend to or witness an event or series of events for the purpose of learning, data collection, etc.

OPEN - To move from a closed position; to make available for entry or passage.

OPERATE - To put or keep in action.

OVERWATCH - To support by fire another element which is moving.

PERFORM - To do, carry out, or bring about.

PLAN - To devise a scheme for doing, making or

PLOT - To mark or note on a map or chart; to locate by means of coordinates.

POSITION - To place oneself or others in a location or posture.

PREPARE - To set in order; to make ready.

PREVENT - To keep from happening or existing.

PRIORITIZE - To assign order of precedence in time, sequence,

PROVIDE - To furnish or supply.

RAISE - To cause to be moved from a lower to a higher position.

RANGE - To determine the distance to a target.

READ - To obtain information from written material

RECALL - To bring forth information from memory.

RECEIVE - To acquire or get; to get knowledge or information about.

RECOGNIZE - To perceive to be something previously known or designated.

RECORD	- To place data or stimulus events into a form for later access or recall.
RECOVER	- To get back; regain.
REDUCE	- To lower or bring down.
REGAIN	- To get back one's possession; to succeed in reaching again; to recover.
RELEASE	- To let go; set free from restraint.
REMOVE	- To take or move away; to take off or eliminate.
REPORT	- To give information regarding the occurrence or status of.
RESET	- To put back into a desired position or condition.
RESOLVE	- To eliminate discrepancies from two or more sources of information.
RESPOND	- To answer, reply; to act in return.
REVIEW/EDIT	- To listen to a record report and revise for accuracy prior to transmission.
ROUTE	- To send by a selected course of travel; to divert in a specified direction.
RUN	- To cause a computer program to be executed.
SAVE	- To cause to be stored or placed in an accessible location.
SCAN	- A close searching look; to make an intensive examination of an area; to glance quickly.
SCHEDULE	- To appoint, assign, or designate for a fixed future time; to assemble into a timetable.
SEARCH	- To look over for the purpose of finding something.
SECURE	- To make safe; to make fast.
SELECT	- To choose from among two or more options.
SEND	- To transmit, as by radio or other communication medium.
SENSE	- To note where the round goes in relation to the target and the target aiming point in the reticle at the time of firing (gunner and TC).

SET - To put equipment into a desired adjustment, condition, or mode.

SET-UP - To prepare or make ready for use.

SIGHT - To look at through or as if through a sight; to aim by means of a sight.

SIGNAL - To communicate by means of a prearranged visual or auditory sign.

SOLVE - To find a solution for.

SPECIFY - To name or state explicitly or in detail.

START - To perform actions necessary to set into operation; to begin.

STEER - To direct the course of.

STORE - To cause to be placed in an accessible location.

SUPPRESS - To employ fires to prevent or hinder enemy observation or return fire.

SLEW - (Also slue.) To rotate around a pivotal point (e.g., slew the gun turrent, etc.).

SLOW - To reduce speed.

STABILIZE - To stop all fluctuations from a desired dynamic conditions, such as speed, heading, etc.

STORE - To put or keep for later recall and use, as in a computer memory unit.

STOW - To place something in an appropriate place and condition when not in use.

SURVEY - To collect information of a predetermined type and on the basis of first-hand observation and measurement, particularly terrain formations and features.

TEST - To perform specified operations to verify the operational readiness of equipment.

TRACK - To follow the moving path of a target with an instrument (e.g., gun sight) in order to determine point of aim, path of interception, or a future position.

TRANSLATE - To convert information from one form into another (usually across languages). Prefer use of "convert" in referring to changing from one metric system to another.

TRANSMIT - To send out communications through electromagnetic energy.

TRAVERSE - To turn a gun laterally; swivel

TURN - To rotate, change angle of motion, cause to move in a curved path.

UNMASK - To move toward a location (e.g., approach the crest of a hill) until a line of sight (LOS) is established between own sensor or weapon and an enemy target or position.

UPDATE - To provide current information on a set of changing conditions.

VERIFY - To confirm a tentative conclusion by using a second opinion or by using a test to resolve any doubt.

VISUALIZE - To create a mental picture or concept of.

WAIT - To suspend activity in a sequence of activities until a given event or condition occurs or a given time has elapsed

WRITE - To inscribe letters, numerals, and other symbols on a surface.

ZERO - To adjust the sight settings of a gun by calibrated firing to determine that the trajectory of a test round intersects the line of sight at zero range. To bring to a desired level or null position.

AVTAWL OBJECT LIST AND DEFINITIONS

ACCESS - An unobstructed way or means of approaching or viewing a destination.

ACKNOWLEDGEMENT - A response indicating receipt and understanding of a communication.

ACTIVITY - Action(s) or function(s) carried out by personnel, e.g., enemy troops

AIRCRAFT (A/C) - Airplanes, helicopters, etc. Applies to all manned, powered vehicles designed to travel through air.

ALERT - A warning to be ready or watchful.

ALIGNMENT - The arrangement of parts or components into a straight line.

ALTITUDE - The height of an aircraft above the ground.

AMMO - Short for ammunition. Anything fired, launched, or exploded as a weapon.

ANGLE - The difference between two planes that meet in a point, usually measured in degrees.

AO - Area of operations.

AOA - Avenue of Approach

APPROACHES - Paths providing a means or route for reaching a destination, such as a target area or objective.

AREA - A space on the earth's surface designated for specific unit or vehicle operations.

ARMAMENT - All of the guns, weapons, and equipment serving offensive or defensive purposes on an armored vehicle.

ARTILLERY - Guns of large caliber, too heavy to carry. Mounted guns (exclusive of machine guns) such as cannons and launchers. May be mobile, stationary,

ATGM - Anti-Tank Guided Missile

ATTACK - Offensive acts and maneuvers associated with an assault against an enemy.

BEARING - The position or direction established by determining the number of degrees away from a known point, usually from the nose of the vehicle.

CCP - Computer Control Panel

CHANNELS - A band of frequencies selected to transmit or receive communications.

CITV - Commander's Independent Thermal Viewer

CHECKS - The series of steps taken to examine or determine if something is as it should be.

CODE(S) - A set of signals or symbols used in sending messages, information processing, or transferring information from a sensor.

COMPUTER - The ballistic computer uses stored (automatic inputs) and manual input data to improve gun aiming accuracy.

CONSTRAINTS - The restriction or confinement within prescribed limits or boundaries.

CONTENT - Essential meaning or substance in a written or spoken message.

CONTROL - A mechanism used to regulate and/or adjust vehicle system or equipment.

COORDINATE - Any value of a system of two or more magnitudes used to define a position or a point, usually on a map or on the earth. The value will identify the point of interest.

COVER - A hiding place or area where an armored vehicle will be hidden or concealed from an enemy.

DAMAGE - Harm or injury to things (targets, vehicles, etc.).

DASH - A sudden, swift movement of a vehicle to a destination.

DATA - Things known or assumed; facts and figures from which conclusions can be inferred; information.

DESIGNATOR - A device or capability of a sensor to point out; to mark; to indicate or to specify.

DESTINATION - The place toward which someone or something is going or sent.

DIMENSIONS - Extent, size, shape of objects or targets.

DIRECTION - The point or line along which a threat or target is moving or lies.

DISPLAY(S) - Arrangements of instruments, indicators, or electro-optical viewing surfaces on which information can be coded and presented to crew members.

DISTANCE - The spatial interval between two points, objects, lines, etc.

ENGINE - The power plant that propels the vehicle over the ground.

EQUIPMENT - Supplies, furnishings, apparatus onboard the vehicle or carried by a crew member.

EVASION - The avoidance of a threat.

FCC - Fire Control Computer. An automic data processing device for calculating weapon paramenters and for controlling weapon firing operations for maximum engagement effectiveness.

FIRE - A discharge of firearms or artillery; shooting.

FORMAT - The general makeup, arrangement, or organization of a message.

FORMATION - An arrangement or positioning of armored vehicles while moving.

FORMS - Printed documents with blank space to be filled in to report on aircraft or mission status and results.

FOV - Field of view. An area of observation as through a sensing device or from a visual position.

FREQUENCY - The method of identifying (usually in Hertz or cycles per second) specific carrier waves used in radio communications and for radio navigation equipment.

FUEL - Material burned by the engine to produce power for the vehicle.

GAS - Gunner's Auxiliary Sight

GPS - Gunner's Primary Sight

GPS-E - Gunner's Primary Sight Extension. Provides commander with optics for aiming the main gun and coaxial machinegun during the day or night.

GUN - A weapon consisting of a metal tube from which a projectile is discharged by the force of an explosive.

HANDOFF - An offensive maneuver in which target information is transferred from a scout to an attack vehicle or from one attack vehicle to another.

HEADING - The direction a vehicle is moving, usually expressed as a compass reading.

HEAT-T - High Explosive Anti-Tank with Tracer

HEP-T - High Explosive Plastic with Tracer

HIT - A blow from a weapon as it strikes its mark.

IMPACT - The contact and resulting destruction when a weapon strikes a target.

INDICATORS - Devices such as gauges, dials, registers, or printers that measure and visibly display information required by crew members.

INSTRUMENTS - Devices for indicating or measuring condition, performance, position, direction of movement, and operation of vehicle subsystems.

ITEMS - Particular things or units in an inventory or a list of things.

JOIN-UP - A maneuver performed with the objective of entering and becoming a member of a formation of vehicles or the completion of a planned redezvous with another vehicle.

LANDMARK - A prominent feature of the landscape serving to identify a particlular locality or position of a vehicle or target.

LASER - (Light Amplification by Stimulated Emission of Radiation). A device in which atoms, when stimulated by focused light waves amplify and concentrate the waves, then emit them in a narrow intense beam. Used as a sensor to designate, aim, and direct a weapon or to measure range.

LASER CUE - A model of operation enabling a sensor to receive target location from a laser.

LASER RANGE FINDER (LRF) - A device that emits a focused beam of amplified light waves onto a distant object or target in order to measure range.

LINE OF SIGHT (LOS) - An imaginary straight line joining the center of the eye of an observer with the object viewed.

LOCATION - An area marked off or designated for a specific purpose.

LRF - Laser Range Finder

MANEUVER(S) - Any change of movement by a vehicle.

MAP - A printed representation of the earth's surface showing ground features, such as a mountains, bodies of waters, roads, cities, etc.

MESSAGE - A communication passed or sent between crew members or outside sources by speech, electro-optical, or other signal means.

MISSION - A specific combat operation assigned to a vehicle and its crew.

MODE(S) - A manner or way of operation, the methods of employment.

MOVEMENT - A change of location of a tank, an aircraft, troops, etc., as part of an operation or maneuver.

OBSERVATION - Reconnaissance to gain information about the terrain and enemy.

OVERWATCH (OW) - Surveillance of terrain on which an enemy might be positioned in order to provide warning and covering fires to friendly vehicles.

PATTERN - A prescribed route or movement for the flow of vehicle traffic; a grouping or distribution such as from a number of bullets, rockets, or missiles when they are fired at a mark

PERCENTAGE - The amount or number expressed in rate per hundred.

PERISCOPE - A mirrored device that provides the Commander, Driver, Gunner,and Loader with visual access to the exterior.

POINT - A particularly or precisely specified location, place, or spot on a map, course, or in a target area.

POSITION - The place where a vehicle, target, landing zone, or other operational thing is, especially in relation to others or to a system of navigation.

POWER - The capacity of the vehicle propulsion system in terms of the rate at which it can produce energy for movement.

PRESSURE - A force exerted against a control lever.

RADIO - A electronic set capable of transmitting and receiving message carried by electromagnetic energy through space, within prescribed frequencies.

RANGE - The maximum effective distance that a vehicle can operate without refueling; or that a weapon can effectively fire its projectile.

RECEIVER - An electronic device that coverts incoming electromagnetic energy or electromagnetic energy or electrical signals into audible or visuals signals.

RECORD - The report of events stored in a reading device.

RECORDER - A device for recording mission data or messages.

REPORT - An account of facts or the record of some observation or event.

RETICLE - A network of fine lines, wires, etc. in the focus of a sensor or sight used to aid alignment or aiming.

ROUTE - The path traversed by a vehicle from one point to another.

RP - Red Phosphorus

SCAN - A systematic search pattern from an electronic sensor.

SABOT - Armor piercing, discarding sabot (APDS-T).

SCOUT - A vehicle sent out to observe, reconnoiter the strength, movements, etc. of the enemy and to direct attacking armored vehicles against enemy targets.

SEARCH - An act of scrutiny, inquiry, or examination in an attempt to find something (e.g., a target), gain knowledge, establish facts, etc.

SECURITY - A radio device or mode of operation that enable communication not likely to be intercepted by an enemy listener.

SENSOR - Any of various optical or electronic devices designed to detect, measure, or record physical phenomena such as radiation, heat, pressure, etc.

SEPARATION - The distance between two vehicles while in formation.

SIGHT - A device used to aid the eyes in lining up a gun, or electro-optical sensor on a target or objective.

SIGHTING - The act of seeing an object or target.

SIGNAL - A sign or event fixed or understood as the occasion for prearranged combined action. A sign given by gesture, flashing light, etc. to convey a command, direction, warning, etc. A device, as a red flag, flashing light, etc. for processing such as a sign.

SIGNATURE - Blast, flash, dust, smoke, noise, thermal image, etc. created by a target or weapon.

STATION - A post, position, or location where a vehicle assigned for duty or operations.

STATUS - The state or condition as of a weapon or a vehicle system.

SURROUNDINGS - The things, conditions that are present in a given place or within view of an observer.

SURVEILLANCE - A watch kept over a target or battle area.

SWITCH - A device used to activate, open, close, or divert an electric circuit associated with a vehicular system or control.

SYMBOL - A written or printed mark, letter, abbreviation, or geometric form used to represent an object, quality, or process.

SYSTEM - A combination of personnel and equipment organized to provide an effective means for performing a previously established operational function.

TARGET(S) - An objective, goal, tanks, force, etc. that is the object of a military attack.

TERRAIN - Ground or earth, especially with regard to its natural or topographical features or fitness for some use.

THREAT - The source of danger and potential destruction from an enemy force, such as artillery, tank, or aircraft.

THROTTLE - The control that regulates the amount of fuel being metered to the engines(s).

TIS - Thermal Imaging System

TRACERS - Bullets or shells that indicate their own courses in the air with trails of smoke or fire, so as to facilitate adjustment of the aim.

TRACK - A course or line of movement route, way; the projection of the path of a vehicle on the surface of the earth.

TRAFFIC - The movement of a number of vehicles along a prescribed route(s).

TRANSMITTER - The part of a radio or other electromagnetic device that generates waves, modulates their amplitude or frequency, and sends them by means of an antenna.

TRIGGER - A small lever, switch, or part which when pulled or pressed activates the firing of a weapon.

TURNS - A change in direction of movement.

UPDATE - An action taken or a function performed to revise navigation data making it more accurate or concurrent with present vehicle status or position.

UTM - Universal Transverse Mercator. A conventional system for indicating position on the earth's surface. The earth's surface is divided into grids which are 1000 meters square. A position is easily defined in UTM coordinate by a prefix (e.g., B5) which represents a 100,000 x 100,000 meter area followed by easting (3 digits) and northing (3 digits) coordinates which locate a spot within 10 meters.

WAYPOINT - A preselected navigation checkpoint along a planned route of movement.

WEAPON - A instrument or device of any kind that can be used to fight or attack an enemy target.

WP - White Phosphorus

AVTAWL ABBREVIATIONS AND BREVITY CODES

A	- Auditory
A/C	- Aircraft
ACK	- Acknowledge
Adj	- Adjust
Align	- Alignment
AMMO SUBDES	- Ammunition Sub-Designation
AO	- Area of Operations
AOA	- Avenue of Approach
AP	- Armor-Piercing
APDS-T	- Armor-Piercing Discarding Sabot with Tracer
APERS-T	- Antipersonnel with Tracer
APFSDS-T	- Armor-Piercing Fin Stabilized Discarding Sabot with Tracer
API	- Armor-Piercing Incendiary
APIT	- Armor-Piercing Incendiary Tracer
ATGM	- Anti-Tank Guided Missile
AUTO	- Automatic
AUTOVON	- Automatic Voice Operated Network
BAT	- Battery
BD	- Base Detonating
BO	- Blackout
BOT	- Burst on Target
BS ADJUST	- Battlesight Adjust
C	- Cognitive
CAL	- Caliber
CBR	- Chemical, Biological, Radiological
CCP	- Computer Control Panel
CDR	- Commander
CFM	- Cubic Feet per Minute
CI	- Center of Impact
CITV	- Commander's Independent Thermal Viewer
COAX	- Coaxial Machinegun
Comm	- Communication
CP	- Commander's Panel
CTR	- Center
CVC	- Combat Vehicle Crewman
CWS	- Commander's Weapon Station
D	- Down(on Computer Control Panel)
D	- Drive (on Transmission Shift Control)
DEK	- Data Entry Keyboard
Discrim	- Discrimination
DVR	- Driver
EFC	- Effective Full Charge
EFMS	- Electronic Fuel Management System
EL	- Elevation
EL UNCPL	- Elevation Uncouple
F	- Fahrenheit (Temperature)
F	- Fault
F	- Fire

FCC	- Fire Control Computer
FOF	- Field of Fire
FOV	- Field of View
FSDS-T	- Fin Stabilized Discarding Sabot with Tracer
GAS	- Gunner's Auxiliary Sight
GPS	- Gunner's Primary Sight
GPS-E	- Gunner's Primary Sight - Extension
GRC	- Gyro Reticle Compensation
GTD	- Gun Turrent Drive
HEAT-T	- High-Explosive Anti-Tank with Tracer
HEAT-T-MP	- High-Expl. Anti-Tank with Tracer, Multipurpose
HEP-T	- High-Explosive Plastic with Tracer
HI	- High
HQ	- Headquarters
ICU	- Image Control Unit
Ident	- Identification
IFC	- Initial Fire Command; Indirect Fire Control
IFF	- Identification - Friend or Foe
Intrp	- Interruption
Intrpty	- Interruptibility
K	- Kinesthetic
L	- Low (on Transmission Shift Control)
L	- Left (on Computer Control Panel)
LOS	- Line of Sight
LRF	- Laser Rangefinger
M	- Muscular
MA	- Muzzle Action
MALF	- Malfunctions
MILS	- Unit of Measure for Angles or Arcs
MIL/S	- Unit of Measure for Angles or Arcs per Second
MRS	- Muzzle Reference Sensor (Collimator)
N	- Neutral
Nav	- Navigation
NBC	- Nuclear, Biological, Chemical
NORM	- Normal
OW	- Overwatch
PCU	- Power Control Unit
PE	- Performance Element
PMCS	- Preventive Maintenance Checks and Services
POSN	- Position
PRESS	- Pressure
PVT	- Pivot
PWR	- Power
R	- Reverse (on Transmission Shift Control)
R	- Right (on Computer Control Panel)
RADIO TRANS	- Radio Transmit
RCVR	- Receiver
rdspm	- Rounds Per Minute
Recog	- Recognition
RETRANS	- Retransmit
RP	- Red Phosphorus
SAP	- Special Armor Program
Sec(s)	- Second(s)
Sgt	- Sight

STANO	- Surveillance, Target Acquisition, Night Observation devices.
Stab	- Stabilization
STBY	- Standby
Tgt	- Target
TRP	- Target Reference Point
TRU	- Thermal Receiving Unit
U	- Up
WP-T	- White Phosphorous with Tracer
V, Vis	- Visual

AVTAWL DEVICES AND EQUIPMENTS LIST

CROSSWIND SENSOR (24): Provides measurement of crosswind speed at the tank for input to the ballistic computer.

MAIN GUN -105MM (29): Provides main armament for tank.

MUZZLE REFERENCE SENSOR (COLLIMATOR) (30): As part of muzzle reference system, provides gunner a reference point to determine gun tube bend caused by heat for manual input to ballistic computer.

GUNNER'S PRIMARY SIGHT BALLISTIC SHIELD COVER (33): Protects gunner's primary sight head assembly from small caliber fire and shell fragments.

COMMANDER'S WEAPON STATION (CWS) MACHINEGUN (34): Provides small caliber firepower and can be fired when commander's hatch (35) is opened or closed.

COMMANDER'S HATCH (35): Provides commader 360 degree protected viewing from closed, protected open, and full-open positions.

LOADER'S MACHINEGUN -7.62MM (36): Provides small caliber firepower.

LOADER'S HATCH (37): Provides crewmembers with normal entrance and exit to and from tank.

SMOKE GRENADE DISCHARGER (38): Provides smoke to screen tank. There is one discharge on each side. Smoke grenade are fired from command's station.

GUNNER'S AUXILIARY SIGHT (1): Allow gunner to aim main gun if GPS is not operating. The sight contains reticles for SABOT, HEAT, and HEP 105mm rounds.

GUNNER'S PRIMARY SIGHT (GPS) (2): Provides gunner with optics for aiming the main gun and coxial machinegun during the day or night. Allows gunner to control ranging, sighting, and ammunition selection.

COMMANDER'S GPS EXTENSION (3): Provides commander with opticsl for aiming the main gun and coxial machinegun during the day, or night, by observing exactly what the gunner sees through the GPS.

COMMANDER'S WEAPON SIGHT (4): Allows the commander to aim the commander's weapon from inside the turrent. The sight contains a ballistic reticle for the caliber.50 machinegun.

COMPUTER CONTROL PANEL (5): Allows gunner to use and control computer in sighting main gun and coaxial guns.

COMMANDER'S PANEL (6): Provides commander status data and control of tank main systems.

COMMANDER'S WEAPON STATION (7): Provides commander open and closed hatch control of his caliber .50 machinegun in manual or power mode. Vision blocks provide 360 degree field of view.

105MM HULL AMMUNITION COMPARTMENT (8): Permits stowage of eight rounds of 105mm ammunition for main gun. If an enemy round should enter the compartment and explode, blowoff panels under or on top of the compartment will direct the explosion away from the turrent and the crew.

105MM BUSTLE AMMUNITION COMPARTMENT (9): Permits stowage of forty-four rounds of 105mm ammunition for main gun. Twenty-two rounds are in the ready ammunition compartment behind the loader and twenty-two rounds in the semi-ready ammunition compartment behind the commander.

105MM TURRET FLOOR READY RACK (10): Permits stowage of three rounds of 105mm ammunition for main gun.

MAIN GUN BRLECH (11): Provides loader opening for loading gun.

DRIVER'S INSTRUMENT PANEL (12): Shows driver the status of tank hull systems.

STEER-THROTTLE CONTROL (13): Allows driver to control engine speed and steer tank at the same time.

DRIVER'S ALERT PANEL (14): Alerts driver to unusual or dangerous conditions in the tank systems. Driver must check his instrument panel to pinpoint cause of alert.

DRIVER'S MASTER PANEL (15): Controls starting and shut-down of engine, lights, and auxiliary sytems.

POWERPACK (16): Includes turbine engine, exhaust system and transmission. Provides primary power for tank movement and electrical and hydraulic power for auxiliary systems.

AMMUNITION (AC;AL)

ALM	AMMO LOADING; MAIN GUN
ALC	AMMO LOADING; CW
ALX	AMMO LOADING; COAX
ALL	AMMO LOADING; LOADER'S
ASM	AMMO STATUS; MAIN GUN
ASX	AMMO STATUS; COAX
ASL	AMMO STATUS; LOADER'S
AMC	AMMO MONITORING; CDR

COMMUNICATIONS (CC;CD;CG;CL)

CIC	COMMO; INTERCOM, CDR
CID	COMMO; INTERCOM, DRIVER
CIG	COMMO; INTERCOM, GUNNER
CIL	COMMO; INTERCOM, LOADER
CRC	COMMO; RADIO, CDR
CRL	COMMO; RADIO, LOADER
CHS	COMMO; HAND SIGNALS
CWR	COMMO; WRITTEN
CFL	COMMO; FLARES
CCM	COMMO; COMPUTER (FUTURE)

INDICATORS & CONTROLS (IC;ID;IG;IL)

ICP	COMMANDER'S PANEL
ICU	COMMANDER'S UTILITES
IDP	DRIVER'S PANEL
IDU	DRIVER'S UTILITIES
IGP	GUNNER'S PANEL
IGU	GUNNER'S UTILITIES
ILP	LOADER'S PANEL
ILU	LOADER'S UTILITIES

MENTAL ACTIVITIES (MC;MD;MG;ML)

MAC	MENTAL ANALYSIS, CDR
MAD	MENTAL ACTIVITIES, DRIVER
MAG	MENTAL ACTIVITIES, GUNNER
MAL	MENTAL ACTIVITIES, LOADER
MDC	DECSION MAKING, CDR
MDD	DECISION MAKING, DRIVER
MDG	DECISION MAKING, GUNNER
MDL	DECISION MAKING, LOADER
MMC	MEMORY, CDR
MMD	MEMORY, DRIVER
MMG	MEMORY, GUNNER
MML	MEMORY, LOADER
MPC	PROBLEM SOLVING, CDR
MPD	PROBLEM SOLVING, DRIVER
MPG	PROBLEM SOLVING, GUNNER
MPL	PROBLEM SOLVING, LOADER
MRC	MEMORY RECALL, CDR
MRD	MEMORY RECALL, DRIVER
MMG	MEMORY RECALL, GUNNER
MML	MEMORY RECALL, LOADER

NAVIGATION (NC;ND)

NCC	NAVIGATION CONTROL, CDR
NMD	MOTION CONTROL, DRIVER

SURVIVABILITY (SC;SD;SG;SL)

SSG	SMOKE GRENADES
SSE	SMOKE EXHAUST
SGP	GAS PARTICULATE
SFC	FIRE EXTINGUISHING, CDR
SFD	FIRE EXT., DRIVER
SFG	FIRE EXT., GUNNER
SFL	FIRE EXT., LOADER

TARGET ACQUISITION (TC;TG)

TGP	GPS
TPX	GPS-EXTENSION
TGA	GAS
TLC	LRF; CDR
TLG	LRF; GUNNER
TTI	TIS
TCW	CWS SIGHT

UTILITITIES (UC:UD:UG:UL)

UHC	HATCHES, CDR
UHD	HATCHES, DRIVER
UHG	HATCHES, GUNNER
UHL	HATCHES, LOADER

VISUAL (VC:VD:VG:VL)

VXU	OPEN HATCH; UNAIDED
VXA	OPEN HATCH; AIDED
VPC	PERISCOPE; CDR
VFP	FORWARD PERISCOPE; CDR
VPD	PERISCOPE; DRIVER
VPG	PERISCOPE; GUNNER
VPL	PERISCOPE; LOADER
VMP	VISUAL; MAPS

WEAPON CONTROL (WC:WG:WL)

WBC	BALLISTICS COMPUTER; CDR
WBG	BALLISTICS COMPUTER; GUNNER
WMC	MAIN GUN CONTROL; COMMANDER
WMG	MAIN GUN CONTROL; GUNNER
WCW	COMMANDER'S WEAPON CONTROL
WLW	LOADER'S WEAPON CONTROL
WFM	WEAPON FIRING; MAIN GUN
WFC	WEAPON FIRING; CDR'S WEAPON
WFX	WEAPON FIRING; COAX
WFL	WEAPON FIRING; LOADER

AVTAWL CREW WORKSTATION DESCRIPTIONS AND EQUIPMENT-SPECIFIC TASKS

M1 Commander's Equipment-Specific Tasks

Control or Indicator	Verb	Task No.	Sub-System	Equipment Description
AUX HYDRAULIC POWER light	check	C001 C002	ICU ICU	Lights green when aux. hydr. system is on.
AUX HYDRAULIC POWER Switch	locate operate	C003 C004	ICU ICU	Used to turn on or shut off aux hydr system - when veh. master switch is on & veh. engine is not running.
CKT BKR OPEN light	monitor check	C005 C006 C007	ICU ICU ICU	Lights yellow if any manually reset turret circuit breaker is open
CKT BKR re-set switches	check operate	C008 C009	ICU ICU	Resets circuit breaker
ENGINE FIRE light	monitor	C010	SFC	Flashes red to warn that fire is in engine compartment.
FIRE CONTROL MALF light	monitor	C011	ICU	Lights red if malfunction in fire control system.
Freq. selector control (C-2742/VRC)	check change operate	C012 C013 C014	CRC CRC CRC	Turns radio set on and off & selects frequency channel.
GPS-E eyepiece	locate activate observe analyze adjust	C015 C016 C017 C018 C019	TPX TPX TPX TPX TPX	Shows tank commander the target and gun sighting view and data in the gunner's primary sight (GPS).
Intercom cont. (C-10456/VRC)	change check operate	C020 C021 C022	CRC CRC CRC	Selects commander's intercom and radio operation.
Locking lever	check lock pull push unlock	C023 C024 C025 C026 C027	UHC UHC UHC UHC UHC	Unlocks hatch from protected open and full open positions.
LOW BAT CHG light	monitor	C028	ICU	Lights yellow when battery is low.
MANUAL RANGE ADD-DROP switch	locate operate	C029 C030	WBC WBC	Manually adjusts range input to computer after BATTLE SGT pushbutton is pressed.

MANUAL RANGE BATTLE SGT pushbutton	locate operate	C031 C032	WBC WBC	Directs ballistic computer to use preset range value for selected ammo vis auto. inputs.
(CWS) manual traverse ring	locate operate	C033 C034	WCW WCW	Traverses CWS during manual traverse ring operation.
Operating handle	check locate lock unlock	C035 C036 C037 C038	UHC UHC UHC UHC	Latches and unlatches cdr's hatch in closed position.
panel: Commander's	scan	C039	ICP	Contains cdr's control switches & indicator lights (see 2-15).
PANEL LIGHTS knob	locate operate	C040 C041	ICP ICP	Controls brightness of cdr's & loader's panel lights.
PANEL LIGHTS TEST pushbutt.	locate operate	C042 C043	ICP ICP	Turns on all cdr's & ldr's panel lights to max. bright.
periscope: Forward unity	align observe	C045 C046	TCW TCW	Allows commander to aim cdr's weapon using fixed ring sights under weapon mount.
periscopes: unity	observe	C047	VPC VPC	Provides non-magnified of vision. Full 360-degree field covered by six periscopes around cdr's hatch.
POWER/MANUAL lever	check locate operate	C048 C049 C050	WCW WCW WCW	Selects powered or manual azimuth operation of CWS.
power control handle: Commander's INCLUDES:	elevate locate traverse	C051 C052 C053	WMC WMC WMC	Controls main gun elevation & traverses turret during powered operation. Button on handle controls LFR; trigger fires main gun or coaxial machinegun.
LFR button	locate operate	C054 C055	TLC TLC	
palm switch	operate	C056	WMC	
trigger:COAX	locate operate	C057 C058	WFX WFX	
trigger:main	locate operate	C059 C060	WFM WFM	
READY/SAFE switch	check locate operate	C061 C062 C063	SSG SSG SSG	Arms/disarms smoke grenade firing circuit.

remote inter-com switch	check	C064	CIC	Permits commander to transmit on intercom or radio without using switch on CVC helmet.
	locate	C065	CIC	
	operate	C066	CIC	
SALVO 1 & 2 pushbuttons	locate	C067	SSG	Fires 6 grenades, 3 per side.
	operate	C068	SSG	
T-handle	check	C069	UHC	Locks and unlocks hatch in yoke assembly.
	locate	C070	UHC	
	lock	C071	UHC	
	unlock	C072	UHC	
TURRET POWER light	check	C073	ICU	Lights green when turret electric power is on.
TURRET POWER switch	check	C074	ICU	Turns turret power on/off. Auto reset to off if power is lost.
	locate	C075	ICU	
	operate	C076	ICU	
VEHICLE MASTER POWER light	check	C077	ICU	Turns green when power is on in tank electrical system.
		C078	ICU	
VEHICLE MASTER POWER switch	check	C079	ICU	Turns elec. power on/off.
	locate	C080	ICU	
	operate	C081	ICU	
weapon elevation crank: Commander's INCLUDES;	locate	C082	WCW	Controls elevation of cdr's weapon. Fires weapon when pulled & includes mechanical safety.
	operate	C083	WCW	
trigger	operate	C084	WFC	
safety	check	C085	WFC	
	operate	C086	WFC	
weapon sight: Commander's	align	C087	WCW	Allows cdr to aim cdr's weapon sight using a ballistic reticle. This reticle is designed for use with the caliber .50 machinegun. Sight provides 3X magnification.
	locate	C088	WCW	
	observe	C089	WCW	
weapon station power control: Commander's INCLUDES:	locate	C090	WCW	Traverses commander's weapon station during power operation when palm switch is depressed & button on handle is moved. Also contains an intercom/ radio switch
	elevate	C091	WCW	
	traverse	C092	WCW	
palm switch	operate	C093	WCW	
thumb control	operate	C094	WCW	
intercom/radio switch	check	C095	CRC	
	locate	C096	CRC	
	operate	C097	CRC	

M1 Gunner's Equipment-Specific Tasks

Control or Indicator	Verb	Task No.	Sub-System	Equipment Description
AMMUNITION SELECT switch	locate	G001	WBG	Inputs ammo type data into ballistic computer when GUN SELECT switch(5) is set to MAIN.
	operate	G002	WBG	
AMMUNITION SELECT light	check	G003	IGP	Shows ammo type selected on AMMUNITION SELECT switch (6) when GUN SELECT switch (5) is set to MAIN or TRIGGER SAFE.
		G004	IGP	
		G005	IGP	
Computer control panel (CCP)	check	G006	WBG	Controls inputs to ballistic computer and shows readouts of inputs (see 2-22).
	scan	G007	WBG	
	read	G008	WBG	
INCLUDES:	input	G009	WBG	
Data keys	locate	G010	WBG	
	operate	G011	WBG	
Function keys	locate	G012	WBG	
	operate	G013	WBG	
Azimuth keys	locate	G014	WBG	
	operate	G015	WBG	
Elevation keys	locate	G016	WBG	
	operate	G017	WBG	
Data display	check	G018	WBG	
	read	G019	WBG	
Ret. adj swtch	locate	G020	WBG	
	operate	G021	WBG	
Func. lights	check	G022	WBG	
COAX fire button	locate	G023	WFX	Fires coaxial machine gun.
	operate	G024	WFX	
Manual elevation crank	locate	G025	WMG	Elevates and depresses main and coaxial guns. Contains emergency MANUAL FIRING device.
	operate	G026	WMG	
INCLUDES:				
Manual Firing device	locate	G027	WFG	
	operate	G028	WFG	
FIRE CONTROL MODE lights	check	G029	IGP	Show normal, emergency, or manual fire control mode.
FIRE CONTROL MODE switch	locate	G030	IGP	Selects normal, emergency, or manual fire control mode. Resets to normal when power is turned off.
	operate	G031	IGP	
GAS; Gunner's auxil. sight	locate	G032	TGA	Allows gunner to aim main gun if GPS is not operating.
	fixate	G033	TGA	

GAS control panel INCLUDES:	locate	G034	TGP	Contains controls to select GAS reticle and filter, and to light and control reticle brightness
	operate	G035	TGP	
GAS reticle bright. cont.	locate	G036	TGP	
	operate	G037	TGP	
GAS reticle select cont.	locate	G038	TGP	
	operate	G039	TGP	
GPS; Gunner's Primary Sight	locate	G040	TGP	Provides primary optical sight for gunner. Reticle controlled by ballistic computer for day or night vision (see 2-19).
	observe	G041	TGP	
	analyze	G042	TGP	
	adjust	G043	TGP	
GPS ballistic door handles	locate	G044	TGP	Open & close GPS ballistic doors.
	operate	G045	TGP	
GPS Diopter adjustment	locate	G046	TGP	Adjusts GPS eyepiece to bring reticle into sharp focus.
	observe	G047	TGP	
	analyze	G048	TGP	
	operate	G049	TGP	
GPS eyepiece	locate	G050	TGP	Allows gunner to use GPS for aiming LRF and main gun and coaxial machinegun.
	observe	G051	TGP	
	analyze	G052	TGP	
GPS FLTR/CLEAR switch	locate	G053	TGP	Positions filter, clear window, or shutter in GPS day optic system.
	operate	G054	TGP	
GPS MAGNIFICATION lever	check	G055	TGP	Selects optical 3X or 10X magnification for GPS day optical system.
	locate	G056	TGP	
	operate	G057	TGP	
GPS RETICLE knob	locate	G058	TGP	Controls GPS reticle brightness.
	operate	G059	TGP	
GPS SYMBOLS knob	locate	G060	TGP	Adjusts brightness of symbols in GPS field of view. Used for both day and TIS operation.
	operate	G061	TGP	
GUN SELECT lights	check	G062	IGP	Show GUN SELECT switch setting.
GUN SELECT switch	locate	G063	IGP	Selects main gun or coax machinegun circuit for firing, or trigger safe so neither gun will fire. Resets to safe when power is turned off.
	check	G064	IGP	
	operate	G065	IGP	
Intercomm control (C-10456/VRC)	locate	G066	CIG	Provides gunner in-tank and radio communication.
	check	G067	CIG	
	operate	G068	CIG	

intercom	locate	G069	CIG	Allows gunner to transmit on
foot switch	operate	G070	CIG	intercom without using switch on CVC helmet.
LRF fire	locate	G071	TLG	Activates laser
button	operate	G072	TLG	
Main gun fire	locate	G073	WMG	Fires main gun
button	operate	G074	WMG	
MANUAL FIRING	locate	G075	WMG	Fires main gun if all electri-
device	operate	G076	WMG	cal power is lost or if gun cannot be fired using normal triggers.
MRS OUT/IN	locate	G077	TGP	Controls mirror that allows
lever	operate	G078	TGP	MRS reticle to appear in GPS optical system.
PANEL LIGHTS	locate	G079	IGP	Controls brightness of GPS and
knob	operate	G080	IGP	TIS indicator lights.
PANEL LIGHTS,	locate	G081	IGP	Turns on all GPS & TIS indica-
TEST button	operate	G082	IGP	tor lights to full brightness.
periscope,	locate	G083	VPG	Provides non-magnified field
unity	observe	G084	VPG	of view.
power control	locate	G085	WMG	Move gun in elevation and
handles	elevate	G086	WMG	traverse turret. Buttons on
INCLUDES:	traverse	G087	WMG	each handle fire LRF & main
LFR button	locate	G088	TLG	gun or coaxial machinegun.
	operate	G089	TLG	
trigger:COAX	locate	G090	WFX	
	operate	G091	WFX	
trigger:Main	locate	G092	WMG	
	operate	G093	WMG	
pressure gage,	monitor	G094	IGU	Shows system hydraulic
hydraulic				pressure.
RANGE switch	locate	G095	TLG	Sets first or last return, or
	check	G096	TLG	safe mode of LRF. LRF returns
	operate	G097	TLG	to safe when turned power is
		G098		turned off. (Switch does not trip to off.)
TIS CONTRAST	locate	G099	TTI	Adjusts contrast of TIS image.
knob	operate	G100	TTI	
TIS FAULT	check	G101	TTI	Indicates a variety of mal-
light	analyze	G102	TTI	functions in TIS when there is turret power to TIS.

TIS FOCUS knob	locate operate	G103 G104	TTI TTI	A push to turn knob that adjusts focus of TIS image.
TIS MAGNIFICATION lever	locate operate	G105 G106	TTI TTI	Selects 3X or 10X magnification for TIS image.
TIS MODE switch	locate operate	G107 G108	TTI TTI	Selects OFF, ON, or STBY mode of TIS.
TIS POLARITY switch	locate operate	G109 G110	TTI TTI	Selects white or black presentation of hot objects in TIS image.
TIS RETICLE knob	locate operate	G111 G112	TTI TTI	Adjusts reticle intensity in TIS image continuously from white to black.
TIS SENSITIVITY knob	locate operate	G113 G114	TTI TTI	Adjust brightness of TIS image.
traverse crank handle	locate operate	G115 G116	WMG WMG	Traverse turrent when palm switch is squeezed and rotated.
TRU READY light	check	G117	TTI	Lights green when thermal receiver is ready for operation.

M1 Driver's Equipment-Specific Tasks

Control or Indicator	Verb	Task No.	Sub-System	Equipment Description
Alert panel	scan	D001	IDU	Gives the driver the first sign of any system fault or cautionary or emergency condition (see 2-5).
	check	D002	IDU	
BRAKE P/S lights	check	D003	IDU	Lights red when parking brake is set, or not fully released, or service brake is fully or partially engaged for more than two minutes when vehicle engine is running.
brake pedal: parking	check	D004	NMD	Controls hydraulic operation of brakes in transmission.
	locate	D005	NMD	
	operate	D006	NMD	
brake pedal: service	check	D007	NMD	Operates the brakes in the transmission.
	locate	D008	NMD	
	operate	D009	NMD	
brake release handle	check	D010	NMD	Releases parking brake.
	locate	D011	NMD	
	operate	D012	NMD	
Driver Instrument panel	scan	D013	IDP	Provides gages to show driver engine rpm, vehicle speed, fuel quantity, and electrical system voltage. It also includes caution and warning lights to tell driver of faults or emergency conditions in major tank systems.
	check	D014	IDP	
	read	D015	IDP	
	analyze	D016	IDP	
	evaluate	D017	IDP	
Driver master panel	scan	D018	IDU	Contains control switches and indicator lights for engine starting and for vehicle electrical lighting, and auxiliary systems (see 2-5).
	check	D019	IDU	
	locate	D020	IDU	
	operate	D021	IDU	
Fire detector sensor	monitor	D022	SFD	Monitors driver's areas for fire.
		D023	SFD	
FUEL gage	monitor	D024	IDP	Shows fuel level in tank selected on TANK SELECTOR switch.
	check	D025	IDP	
	read	D026	IDP	
Hatch lifting handle	locate	D027	UHD	Lifts or lowers driver's hatch to raised or closed (locked)
	lift	D028	UHD	
	lower	D029	UHD	

Hatch opening crank	locate operate	D030 D031	UHD UHD	Rotates driver's hatch clear of hatch opening. Used only when hatch lifting handle is set to raised position.
Intercomm control	locate operate	D032 D033	CID CID	Provides driver in-tank communication (C-10456/VRC)
intercom switches (remote)	locate operate	D034 D035	CID CID	Allow driver to transmit on intercom without using switch on CVC helmet.
IDLE switch	locate operate	D036 D037	IDU IDU	Selects engine tactical idle speed of about 1350 rpm.
LIGHTS switch	locate operate	D038 D039	IDU IDU	Turns power on/off to outside blackout markers, stop light, & service lights (headlights).
LOW FUEL LEVEL light	monitor check	D040 D041	IDP IDP	Lights yellow when fuel level in rear tank drops below 1/4.
MASTER CAUTION light	monitor	D042	IDU	Lights yellow to alert driver to look for vehicle fault indication on his instrument panel.
MASTER POWER light	check	D043	IDU	Lights green when power is on in tank electrical system.
MASTER WARNING light	check monitor	D044 D045	IDU IDU	Lights red to warn driver to look at the instrument panel for warning of critical condition in engine or transmission; lights in case of engine fire; lights if PARKING/SERVICE BRAKES light on driver's master panels is lit.
NIGHT PERISCOPE light	check	D046	IDU	Lights green when power is applied to night periscope.
NIGHT PERISCOPE switch	locate operate	D047 D048	IDU IDU	Turns power on/off to night periscope.
Periscope adjust. knobs	locate operate	D049 D050	VPD VPD	Raise or lower periscope viewing angle. Total adjustment range is 8 degrees. Two adjustment knobs are on each periscope.
Periscope washer pump	locate operate	D051 D052	VPD VPD	Squirts washing fluid on driver's center periscope when rubber foot button is pressed.

Driver's periscope wiper lever	locate operate	D053 D054	VPD VPD	Operates wiper blades on driver's center periscope.
RESET pushbutton	locate operate	D055 D056	IDU IDU	Turns off MASTER CAUTION light when pressed; and turns off MASTER WARNING light when pressed after engine overspeed or overtemperature condition .
SMOKE GENERATOR light	check	D057	SSE	Lights green when power is applied to smoke generator in engine exhaust duct.
SMOKE GENERATOR switch	locate operate	D058 D059	SSE SSE	Turns power on/off to smoke generator.
SPEED (Veh.) Indicator	monitor check read analyze	D060 D061 D062 D063	IDP IDP IDP IDP	Shows tank speed in kilometers per hour (MPH) for forward or reverse tank movement. Also distance traveled in kilometers.
START pushbotton	locate operate	D064 D065	IDU IDU	Provides automatic engine start.
STARTED light	check	D066	IDU	Lights green for 10 seconds when engine has started successfully.
Steer-throttle control	locate grasp turn (RH) turn (LH) twist (RH) twist (LH)	D067 D068 D069 D070 D071 D072	NMD NMD NMD NMD NMD NMD	Steers tank when moved left or right as a steering bar. Twist grips control engine speed..
TANK SELECTOR switch	locate operate	D074 D075	IDU IDU	Selects tanks for fuel level check on fuel gage (14). Turns on front fuel pump when LOW FUEL LEVEL light (15) is lit.
Transmission shift control	locate operate observe check	D076 D077 D078 D079	NMD NMD NMD NMD	Sets transmission to N (neutral), PVT (pivot), R (reverse), D (drive-normal forward speed range), or L (low forward speed range.)

M1 Loader's Equipment-Specific Tasks

Control or Indicator	Verb	Task No.	Sub-System	Equipment Description
ammo door lock (ready)	locate	L001	ALM	Locks ready ammunition door open for loading ammunition.
	operate	L002	ALM	
ammo door lock (semi-ready)	locate	L003	ALM	Locks semi-ready ammunition door closed during normal operation.
	operate	L004	ALM	
Audio freq. amplifier (AM-1780/VRC)	locate	L005	CRL	Amplifies crew intercom and external radio signals. Controls radio and intercom operation.
	operate	L006	CRL	
	change	L007	CRL	
	adjust	L008	CRL	
	check	L009	CRL	
	monitor	L010	CRL	
Fire detector sensor (left)	monitor	L011	SFL	Monitors turret area for fire.
Fire detector sensor (right)	monitor	L012	SFL	Monitors turret area of fire.
Fire detector (upper)	monitor	L013	SFL	Monitors turret area of fire.
GUN/TURRET DRIVE LIGHTS	check	L014	ILP	Show operating mode of gun/turret drive system.
GUN/TURRET DRIVE switch	locate	L015	ILP	Sets gun and turret drive system to powered, manual, or elevation uncoupled mode.
	operate	L016	ILP	
	check	L017	ILP	
Loader's hatch	locate	L018	UHL	Permits crew entry into, or exit from tank.
	open	L019	UHL	
	close	L020	UHL	
Hatch-closed handle	locate	L021	UHL	Latches and unlatches loader's hatch in closed position.
	lock	L022	UHL	
	unlock	L023	UHL	
Hatch-open lock	locate	L024	UHL	Unlocks hatch from half open (vertical) and full open positions.
	operate	L025	UHL	
Intercom control (C-10456/VRC)	locate	L026	CIR	Provides loader in-tank commo and radio operation. (Can also be used by training monitor to communicate through intercom).
	operate	L027		

knee switch: Loader's	locate	L028	ALM	Opens and closes ammunition bustle door (stowed in up position).
	operate	L029	ALM	
MAIN GUN STATUS lights	check	L030	ILP	Show armed or safe status of main gun firing circuit.
	observe	L031	ILP	
Periscope	locate	L032	VPL	Provides non-magnified field of view; rotates through 360.
	observe	L033	VPL	
	rotate	L034	VPL	
Receiver (R-442/VRC)	locate	L035	CRL	Monitors selected communication channel.
	operate	L036	CRL	
	change	L037	CRL	
	adjust	L038	CRL	
	check	L039	CRL	
	monitor	L040	CRL	
Receiver-Transmitter (RT-246/VRC)	locate	L041	CRL	Provides radio communication capability.
	operate	L042	CRL	
	adjust	L043	CRL	
	change	L044	CRL	
	check	L045	CRL	
	monitor	L046	CRL	
Turret traverse lock lever	locate	L047	ILU	Mechanically locks turret to prevent traversing.
	operate	L048	ILU	

AVTAWL "GENERIC" TASK LIST

OBJECT	VERB	TASK NO.	SUBSYSTEM(S) INVOLVED			
			CDR	DRIVER	GUNNER	LOADER
access	analyze	001C,D	VC	VD		
see also:	check	002C,D	VC	VD		
terrain	locate	003C,D	VC	VD		
	maintain	004C	MAC,MMC			
	obscure	005C,D	MAC	SSE		
	record	006C	CWR,IPC			
	report	007C,D	CC	CID		
Activity	search	008C,D,G,L	VC	VD	VG	VL
(enemy)	analyze	010C	MAC			
see also:	report	011C,D,G,L	CRC	CID	CIG	CIL,CRL
traffic	suppress	012C,G,L	WC		WG	WFL
Activity	plan	013C	MAC			
(own)	obscure	014C,D	SSG	SSE		
Aircraft	alert	013C,D,G,L	CIC	CID	CIG	CIL
(A/C)	assign	014C	MDC			
see also;	classify	015C,D,G,L	MAC	MAD	MAG	MAL
target	search	016C,D,G,L	VC	VPD	VPG	VL
	evade	017C,D	MDC	ND		
	lase	018C,G	TLC		TLG	
	locate	020C,G	VC,TPX		VPG,TPG	
	report	021C,L	CRC			CRL
	track	022C,G	TPX,TCW		TGP	
A/C azimuth	estimate	023C,D,G,L	MAC	MAD	MAG	MAL
see also: azimuth						
A/C range	estimate	024C,D,G,L	MAC	MAD	MAG	MAL
see also: range						
Alert	give	025C,D,G,L	CIC,CRC	CID	CIG	CIL,CRL
	signal	026C	CHS,CFL			
Alignment	adjust	026C,D,G,L	TC	ND	TG	WL
	check	027C,G	VFP		VG	
	report	028C,D,G	CIC	CID	CIG	
Ammunition	check	030C,G,L	AMC		WBG	AL
see also:	change	031C,L	AMC			ALM
round	count	032C,L	AMC			ALM
	load	033L				AL
	rotate	034L				ALM
	remove	035G,L			WBG	ALM
	select	036G,L			WBG	ALM

			CDR	DRIVER	GUNNER	LOADER
Angle	adjust	037C,D,G,L	WC,	ND	WMG,WBG	VPL
	calculate	038C	MAC			
	estimate	040	MAC	MAD	MAG	MAL
	report	041C,D,G,L	CIC	CID	CIG	CIL
AO: Area of operations	analyze	042C	MAC			
	assign	043C	MDC			
	change	044C	MDC			
	coordinate	045C	CRC			
	identify	046C	VC			
	observe	047C,D,G,L	VC	VD	VG	VL
	plan	048C	MDC			
Artillery	direct	050C	VC,CRC			
	alert	051C,D,G,L	CIC,CRC	CID	CIG	CIL
	analyze	052C	MAC			
	evade	053C,D	MPC	ND		
	plan	054C	MAC			
	suppress	055C	WFM			
ATGM	alert	056C,D,G,L	CIC	CID	CIG	CIL
	analyze	057C,D,G,L	VC	VD	VG	VL
	evade	058C,D,	MDC	ND		
	report	060C	CRC			
	suppress	061C,G,L	WC		WMG,WFX	WFL
Attack	coordinate	062C	CRC			
	direct	063	CRC			
	execute	064C,D,G,L	CIC,WC	ND	WFG,WFX	WFL
	overwatch	065C	VC			
	plan	066C	MPC			
	report	067C	CRC			
Azimuth	adjust	068C,G	WC		WG,WBG	
	check	070C,G	TC,WBC		TG,WBC	
	determine	071C,G	TC,VC		TG,VG	
	enter	072C,G	WBC		WBG	
	hold	073D		NDS		
	note	074C,D,G,L	VC,TC	VD	VG,TG	VL
	report	075C,D,G,L	CIC,CRC	CID	CIG	CIL,CRL
Bearing	align	076C,D,G,L	WC,TC	NDS,NDT	WG,TG	WLW
	check	077C,D,G,L	VC	VD	VG	VL
	determine	078C,G	TC,VC		TG,VG	
	note	080C,D,G,L	VC,TC	VD	VG,TG	VL
	report	081C,D,G,L	CIC,CRC	CID	CIG	CIL,CRL
Channels	change	082C,L	CRC			CRL
	note	083C,L	CRC			CRL
	select	084C,L	MAC			MAL

			CDR	DRIVER	GUNNER	LOADER
Codes	change	085C,G,L	CRC,WBC		WBG	CRL
	input	086C,G	WBC		WBG	
	recall	087C,G,L	MAC		MAG	MAL
Conceal-	acquire	088C,D	MAC	ND		
ment	analyze	090C,D	MAC	MAD		
	check	091C,D	VC	VD		
	plan	092C,D	MAC	MAD		
	regain	093D		ND		
	search	094C,D	VC	VD		
	select	095C,D	MDC	MDD		
Coordinate	assign	096C	MDC			
	change	097C	MDC			
	check	098C	MAC			
	copy	100C	CWR			
	determine	101C	MAC			
	enter	102C,G	WBC		WBG	
	estimate	103C	MAC			
	record	104C	CWR			
cover = concealment						
damage	analyze	105C,D,G,L,	MAC	MAD	MAG	MAL
(self)	report	106C,D,G,L	CIC,CRC	CID	CIG	CIL,CRC
damage	analyze	107C,D,G,L	MAC	MAD	MAG	MAL
(enemy)	report	108C,L	CRC			CRL
dash	coordinate	110C,D	MAC	MAD		
	execute	111C,D	MAC	ND		
	plan	112C,D	MAC	MAD		
data	acquire	113C,D,G,L	VC,CRC	VD	VG	VL,CRL
	analyze	114C,D,G,L	MAC	MAD	MAG	MAL
	check	115C,D,G,L	VC	VD	VG	VL
	copy	116C	CWR			
	enter	117C,G	WBC		WBG	
	transmit	118C,L	CRC			CRL
designator	= see LRF					
destination	coordinate	120C	CRC			
see also:	identify	121C,D,	VC	VD		
location	obscure	122C,D	MAC,SSG	SSE		
	overwatch	123C	MAC			
	record	124C	CWR			
	select	125C	MDC			
dimensions	determine	126C,D,G,L	VC,TC	VPD	VPG,TG	VL
	record	127C	CWR			
	report	128C,D,G,L	CRC,CIL	CID	CIG	CIL,CRL

			CDR	DRIVER	GUNNER	LOADER
direction	change	130C,D	MDC	ND		
see also:	check	131C,D,G,L	VC	VD	VG	VL
azimuth;	coordinate	132C	CRC			
bearing	designate	133C	MDC			
	maintain	134d		ND		
	monitor	135C	MMC			
display	observe	136C,G	WBC		WBG	
	activate	137G			WBG,TTI	
	adjust	138G			WBG,TTI	
	analyze	140C,G	MAC		MAG	
	change	141G			WBG,TTI	
	check	142C,G	WBC,TTI		WBG,TTI	
distance	observe	143C	VC			
	adjust	144C,D	MAC	ND		
	determine	145	MAC			
	enter	146C,G	WBC		WBG	
	estimate	147C,D,G,L	MAC	MAD	MAG	MAL
	maintain	148D		ND		
	monitor	150C	MMC			
	range	151C,G	TLC		TLG	
	record	152C	CWR			
	report	153C,D,G,L	CIC,CRC	CID	CIG	CIL
evasion	plan	154C,D	MPC	MDD		
	perform	155C,D	MDC	ND		
formation	observe	156C,D	VC	VD		
	adjust	157C,D	MAC	ND		
	coordinate	158C	CRC			
	maintain	160C	MMC	ND		
	plan	161C	MDC			
FOV (field of view)	adjust	162G			TTI	
	change	163C,D	WMC,WCW		TG	
	observe	164C,G	TC		TG	
	scan	165C,D,G,L	VC	VPD	VPG	VL
	slew	166C,D,	WMC,WCW	ND		
	unmask	167C,D	MPC	ND		
frequency	adjust	168C,L	CRC			CRL
see also:	change	170C,L	CRC			CRL
radio	check	171C,L	CRC			CRL
	select	172C,L	CRC			CRL
handoff	plan	173C	MAC			
	execute	174C	CRC			
hit	analyze	175C,G	MAC		MAG	
	record	176C	CWR			
	report	177C,G,L	CIC,CRC		CIG	CRL,CIL

			CDR	DRIVER	GUNNER	LOADER
indicator	activate	178C,D,G,L	IC	ID	IG	IL
	observe	180C,D,G,L	IC	ID	IG	IL
	adjust	181C,D,G,L,	IC	ID	IG	IL
	check	182C,D,G,L	IC	ID	IG	IL
join up	coordinate	183C	CRC			
	execute	184C,D	MAC	ND		
	plan	185C	NC,VMP			
landmark	designate	186C	MAC			
see also:	record	187C	CWR			
location;	report	188C,D,G,L	CIC,CRC	CID	CIG	CIL,CRL
terrain	search	190C,D,G,L	VC	VD	VG	VL
laser	detect	191C,D,G	ICP	ICD	IGP	
(enemy)	evade	192C,D	MDC	ND		
	report	193C,D,G	CIC,CRC	CID	CIG	CRL
LRF (laser	activate	194C,G	TLC		TLG	
range	adjust	195C,G	TLC		TLG	
finder)	aim	196C,G	TLC		TLG	
see also:	check	197C,G	TLC		TLG	
range;	clear	198C,G	TLC		TLG	
G071;	lase	200C,G	TLC		TLG	
G072	lay	201C,G	TLC		TLG	
	range	202C,G	TLC		TLG	
	release	203C,G	TLC		TLG	
	scan	204C,G	TLC		TLG	
LOS (line	acquire	205C,D	MAC	ND		
of sight	check	206C,G	VC,TC		TG	
	evade	207C,D	MAC	ND		
	obscure	208C,D	SSG	SSE		
location=	analyze	210C,D	MAC			
position	assign	211C	MDC			
see also:	change	212C,D	MPC,MDC	ND		
destination	coordinate	213C	CRC			
	designate	214C	CIC			
	obscure	215C,D	SSG	SSE		
	observe	216C,D	VC	VD		
	record	217C	CWR			
Machine Gun	aim	218C,D	WMC		WMG	
COAX	clear	220C	WMC			
	elevate	221C,G	WMC		WMG	
	fire	222C,G	WFX		WFX	
	lay	223C,G	WMC		WMG	
	load	224C	WMC			
	sense	224C,G	WMC		WMG	
	traverse	225C,G	WMC		WMG	

			CDR	DRIVER	GUNNER	LOADER
Machine Gun CWS	aim	226C	WCW			
	clear	227C	WCW			
	fire	228C	WFC			
	lay	230C	WCW			
	load	231C	WCW			
	sense	232C	WCW			
Machine Gun Loader's	aim	233L				WLW
	clear	234L				WLW
	fire	234L				WFL
	lay	235L				WLW
	load	236L				WLW
	sense	237L				WLW
Main Gun	aim	238C,G	WMC		WMG	
	boresight	240C,G	WMC,TPX		WMG,TGP	
	clear	241L				ALL
	elevate	242C,G	WMC		WMG	
	fire	243C,G	WFM		WFM	
	lay	244C,G	WMC		WMG	
	load	245L				ALM
	traverse	246C,G	WMC		WMG	
maneuver (enemy)	analyze	247C,D,G,L	MAC	MAD	MAG	MAL
	report	248C,D,G,L	CIC,CIR	CID	CIG	CIL,CRL
maneuver (own) see also: movement; route	change	250C,D	MDC	NMD		
	conceal	251C,D	NC	ND		
	control	252C	MAC			
	coordinate	253C	NC,CRC			
	execute	254C,D	MAC	NMD		
	follow	255C,D	MAC	MAD,NMD		
	obscure	256C,D	SSG	SSE		
	plan	257C,D	NC	ND		
	select	258C	MDC			
message see also alert report	acknowledg	260	CIC,CRC	CID	CIG	CIL,CRL
	analyze	261	MAC	MAD	MAG	MAL
	clear	262C,G	WBC		WBG	
	copy	263C	CWR			
	dictate	264C	CIC			
	enter	265C,G	CCM		CCM	
	formulate	266C,D,G,L	MAC	MAD	MAG	MAL
	monitor	267C,L	CRC			CRL
	read	268C,D,G	CCM	CCM	CCM	CCM
	record	270C	CCM	CCM	CCM	CCM
	report	271L				CIC
	replay	272C,L	CCM			CCM
	scan	273C,L	CCM			CCM
	store	274C,L	CCM			CCM
	transmit	275C,L	CRC			CRL
	verify	276C,D,G,L	CIC,CRC	CID	CIG	CIL,CRL

			CDR	DRIVER	GUNNER	LOADER	
movement	direct	278C	NC				
(vehicle)	execute	280D		NMD			
see also:	monitor	281C	NC				
maneuver	obscure	282C,D	SSG	SSE			
	plan	282C,D	NC	ND			
movement	alert	283C,D,G,L	CIC,CRC	CID	CIG	CIL,CRC	
(enemy)	analyze	284C,D,G,L	MAC	MAD	MAG	MAL	
	observe	285C,D,G,L	VC	VD	VPG	VL	
	record	286C	CWR				
	report	287C,D,G,L	CIC,CRC	CID	CIG	CIL,CRC	
	suppress	288C,G,L	WFM,WFC		WFM,WFX	WFL	
overwatch	see threat						
pattern	analyze	290C,D,G,L	MAC	MAD	MAG	MAL	
	observe	291C,D,G,L	VC	VPD	VPG	VXU,VPL	
	recognize	292C,D,G,L	MAC	MAD	MAG	MAL	
power	change	293D		NMD			
	observe	294D		IDP			
	start	295D		IDP			
	stop	296D		IDP			
	monitor	297C,D	MAC	IDP			
pressure	adjust	298D		IDP			
see equip-	observe	300D		IDP			
specific	monitor	301D		IDP			
tasks							
range	adjust	302C,G	WMC		WMG		
	calculate	303C	MAC				
	check	304C,G	WMC		WMG		
	enter	305C,G	WBC		WBG		
	estimate	306C,D,G,L	MAC	MAD	MAG	MAL	
	read	307C,G	TC		TG		
	record	308C	CWR				
	report	310C,D,G,L		CIC,CRC	CID	CIG	CIL,CRL
record	access	311C,G	WBC		WBG		
1st see	change	312C,G	WBC		WBG		
	check	313C,G	WBC		WBG		
	copy	314C,G	WBC		WBG		
	prepare	315C,G	WBC		WBG		
	read	316C,G	WBC		WBG		
	store	317C,G	CCM		CCM		
round	change	318C,L	MDC			ALM	
	load	320L				ALM	
	remove	321L				ALM	
	rotate	322L				ALM	
	sense	323C,D,G,	VC	VPD	VG		

			CDR	DRIVER	GUNNER	LOADER
route	adjust	324C,D	NC	ND		
	change	325C,D	NC	ND		
	check	326C,D	VC	VD		
	coordinate	327C	CRC			
	designate	328C	CIC,CRC			
	devise	330C,D	MPC	MPD		
	evaluate	331C,D	NC	ND		
	maintain	332D		NMD		
	observe	333C,D	VC	VD		
search	perform	334C,D,G,L	VC	VD	VG	VL
security	check	335C,D,G,L	MAC	MAD	MAG	MAL
	control	336C	MAC			
	coordinate	337C	CC			
	establish	338C	MPC			
	monitor	340C	MAC			
sensor(own)	activate	341C,G	TC		TG	
see equip-	adjust	342C,G	TC		TG	
specific	aim	343C,G	TC		TG	
list first.	analyze	344C,G	TC		TG	
	check	345C,G	TC		TG	
	clear	346C,G	TC		TG	
	disconnect	347C,G	TC		TG	
	observe	348C,G	TC		TG	
	operate	350C,G	TC		TG	
	select	351C,G	TC		TG	
	unmask	352C,D,G	VC	NMD	VG	
sensor	detect	353C,G	TC		TG	
(enemy)	evade	354C,D	MPC	NMD		
	suppress	355C,G,L	WC	WG		WFL
separation	adjust	356D		NMD		
	designate	357C	MDC			
	maintain	358D		NMD		
sight	activate	360C,G	TC		TG	
see also:	adjust	361C,G	TC		TG	
GAS	aim	362C,G	TC		TG	
GPS	check	363C,G	TC		TG	
GPS-E	clear	364C,G	TC		TG	
LRF	deactivate	365C,G	TC		TG	
	focus	366C.G	TC		TG	
	operate	367C,G	TC		TG	
	select	368C,G	TC		TG	
	unmask	370C,D,G	MAC	NMD	MAG	

			CDR	DRIVER	GUNNER	LOADER
sighting	acquire	371C,D,G,L	VC	VD	VG	VL
see also:	alert	372C,D,G,L	CIC,CRC	CID	CIG	CIL,CRL
target	analyze	373C,D,G,L	MAC	MAD	MAG	MAL
threat	check	374C,D,G,L	VC	VD	VG	VL
	evade	375C,D	MPC	MPD,NMD		
	maintain	376C,D	MAC	NMD		
	monitor	377C,D,G,L	VC	VD	VG	VL
	range	378C,G	TC		TG	
	record	380C	CWR			
	report	381C	CRC			CRL
	regain	382C,D	NC	NMD		
	track	383C,D,G,L	VC	VD	VG	VL
	verify	384C	MAC			
signal	identify	385C,D,G,L	MAC	MAD	MAG	MAL
	report	386C,D,G,L	CIC,CRC	CID	CIG	CIL,CRL
	search	387C,D,G,L	VC	VD	VG	VL
signature	analyze	388C,G	MAC		MAG	
	classify	390C,G	MAC		MAG	
	identify	391C,G	MAC		MAG	
	locate	392G			TG	
	search	393C,G	VC		VG	
	verify	394C,G	MAC		MAG	
surveil-	coordinate	395C	CRC			
lance	establish	396C	MPC			
	evade	397C,D	MDC	NMD		
	obscure	398C,D	SSG	SSE		
	perform	400C,D,G,L	VC	VD	VG	VL
	report	401C,D,G,L	CIC,CRC	CID	CIG	CIL,CRL
switch	check	402C,D,G,L	IC	ID	IG	IL
1st see	locate	403C,D,G,L	IC	ID	IG	IL
equip list	operate	404C,D,G,L	IC	ID	IG	IL
symbol	check	405C,G	TC		TG	
see also:	enter	406x				
display	identify	407C,D,G,L	MAC	MAD	MAG	MAL
	input	408x				
	observe	410C,D,G,L	TC		TG	
	transmit	411x				
target	acquire	412G			TG	
see also:	analyze	413C,D,G,L	MAC	MAD	MAG	MAL
	approach	414C,D	NC	NMD		
	assign	415C	MDC			
	change	416C	MDC			
	classify	417C	MAC			
	designate	418C	MDC			
	handoff	420C	CIC,CRC			
	identify	421C,D,G,L	MAC	MAD	MAG	MAL
	input	422x				

			CDR	DRIVER	GUNNER	LOADER
	lase	423C,G	TLC		TLG	
	lead	424C,G,L	WC		WG	WLW
	locate (U)	425C,D,G,L	VC	VD	VG	VL
	locate (A)	426C,G	TC		TG	
	observe(U)	427C,D,G,L	VC	VD	VG	VL
	observe(A)	428C,G				
	prioritize	430C	MDC			
	range	431C,G	TLC		TLG	
	report	432C,D,G,L	CIC,CRC	CID	CIG	CIL,CRL
	search (U)	433C,D,G,L	VC	VD	VG	VL
	search (A)	434C,G	TC		TG	
	select	435C	MDC			
	track (U)	436C,G,L	WC		WG	WLW
	verify	437C	MAC			
terrain	analyze	438C,D,G,L	MAC	MAD	MAG	MAL
see also:	assign	440C	MDC			
access	identify	441C,D,G,L	MAC	MAD	MAG	MAL
destination	locate	442C,D,G,L	MAC	MAD	MAG	MAL
location	monitor	443C,D,G,L	VC	VD	VG	VL
	obscure	444C,D	SSG	SSE		
	report	445C,D,G,L	CIC,CRC	CID	CIG	CIL,CRL
	search (U)	446C,D,G,L	VC	VD	VG	VL
	search (A)	447C,G	TC		TG	
	select	448C	MDC			
	survey	450C	MAC			
threat	analyze	451C	MAC			
see also:	approach	452C,D	NC	NMD		
target	classify	453C	MAC			
	evade	454C,D	MPC	NMD		
	locate	455C	VC			
	prioritize	456C	MDC			
	range	457C,G	TLC		TLG	
	report	458C,D,G,L	CIC,CRC	CID	CIG	CIL,CRL
	search	460C,D,G,L	VC	VD	VG	VL
	suppress	461C,G,L	WC		WG	WL
	update	462C	MAC			
throttle	operate	463D		NMD		
tracers	evade	463C,D	MDC	NMD		
	observe	464C,D,G,L	VC	VD	VG	VL
	sense	465C,D,G,L	VC	VD	VG	VL
	suppress	466C,G,L	WC		WG	WL
traffic	analyze	467C	MAC			
	range	468C,G	TLC		TLG	
	report	470C,D,G,L	CIC,CRC	CID	CIG	CIL,CRL
	search	471C,D,G,L	VC	VD	VG	VL

			CDR	DRIVER	GUNNER	LOADER
transmitter	activate	472C,L	CRC			CRL
	adjust	473C,L	CRC			CRL
	check	474C,L	CRC			CRL
	operate	475C,L	CRC			CRL
	release	476C,L	CRC			CRL
trigger	arm	477C,G,L	WC		WG	WLW
	check	478C,G,L	WC		WG	WLW
	de-arm	480C,G,L	WC		WG	WLW
	operate	481C,G,L				
turn see: maneuver; movement						
UTM	assign	482C	MDC			
see also:	change	483C	MDC			
location	designate	484C	MDC			
	determine	485C	MAC			
	estimate	486C	MAC			
	locate	487C	VMP			
	note	488C	VMP			
	store	490x				
	translate	491C	MAC			
	update	492C	MAC			
waypoint see: destination location terrain						
weapon(own)	adjust	493C,G,L	WC		WG	WLW
1st see:	aim	494C,G,L	WC		WG	WLW
main gun;	change	495C,G	WC		WG	
COAX;	check	496C,G,L	WC		WG	WLW
m-gun cdr;	coordinate	497C,G,L	MAC		MAG	MAL
m-gun ldr	direct	498C	MDC			
	fire	500C,G,L	WC		WG	WL
weapon	classify	501C	MAC			
(enemy)	destroy	502C,G,L	WC		WG	WFL
1st see:	distribute	503C	MDC			
target	evade	504C,D	MDC	NMD		
	identify	505C,D,G,L	MAC	MAD	MAG	MAL
	lase	506C,G	TLC		TLG	
	locate	507C,G,L	VC		VG	VL
	obscure	508C,D	SSG	SSE		
	observe	510C,D,G,L	VC	VD	VG	VL
	report	511C,D,G,L	CIC,CRC	CID	CIG	CIL,CRC
	search	512C,D,G,L	VC	VD	VG	VL
	suppress	513C,G,L	WC		WG	WFL

AVTAWL MISSION SEGMENT LIST

MISSION: Anti-Armor (Seek and Destroy)

PHASE: Hasty Attack

MISSION SEGMENTS

01 Move to FEBA; Traveling
02 Move to FEBA; Traveling Overwatch
03 Move to FEBA; Bounding Overwatch; Successive Bounds
04 Move to FEBA; Bounding Overwatch; Alternative Bounds
05 Contact with Enemy; Observation
06 Contact with Enemy; Receive Fires
07 Maneuver to Concealment; Cover
08 Maneuver to Concealment; Defilade
09 Obtain LOS with Target(s)
10 Analyze Situation; METT-T
11 Devise Plan; Battle Plan
12 Devise Plan; Scheme of Maneuver
13 Communicate Plan; Crew
14 Communicate Plan; Section
15 Communicate Plan; Platoon
16 Communicate Plan; Company
17 Communicate Plan; FIST (via Company)
18 Maneuver to Battle Position
19 Target Engagement; Main Gun
20 Target Engagement; COAX
21 Target Engagement; (A1; Main Gun and TIS)
22 Target Engagement; (A2 Main Gun and GPS, Emergency Mode)
23 Target Engagement; (A3; Main Gun and GAS)
24 Target Engagement; (A4; Main Gun and Battlesight Gunnery)
25 Fire and Maneuver; Main Gun
26 Fire and Maneuver; Coax
27 Fire and Maneuver; (A1; Main Gun and TIS)
28 Fire and Maneuver; (A2; Main Gun & GPS, Emergency Mode)
29 Fire and Maneuver; (A3; Main Gun and GAS)
30 Fire and Maneuver; (A4; Main Gun & Battlesight Gunnery)
31 Assault; Main Gun
32 Assault; COAX
33 Assault; (A1; Main Gun and TIS)
34 Assault; (A2; Main Gun and GPS, Emergency Mode)
35 Assault; (A3; Main Gun and GAS)
36 Assault; (A4; Main Gun and Battlesight Gunnery)
37 Consolidation

AVTAWL SEGMENT SUMMARY WORKSHEET

Phase_____

Segment #_____:_____ Method_____

MANEUVER FUNCTIONS SUPPORT FUNCTIONS MISSION FUNCTIONS

AVTAWL FUNCTION LIST

Function NO.	Function
01	Acquire Position Data (POSNAV)
02	Acquire Position Data, Shift From Known Point
03	Acquire Targets
04	Adjust Plan
05	Adjust Route
06	Align Heading on Target Bearing
07	Analyze Situation
08	Analyze Terrain
09	Analyze Threat Level
10	Apply Immediate Action
11	Assess Damage
12	Check Vehicle Systems (Holding)
13	Check Vehicle Systems (Power Change)
14	Check Course Required
15	Check Sensor Operation
16	Check Sights
17	Communicate (Voice, Intercom)
18	Communicate (Radio)
19	Coordinate Mission
20	Coordinate Target Selection
21	Control Fires (Section)
22	Control Fires (Platoon)

23 Deploy to Cover

24 Designate Target

25 Detect Threat, Automatic Search, Cueing

26 Detect Threat, Unaided

27 Detect Target (Prepoint, Auto Cueing, etc.)

28 Detect Target (Ground), Free Search

29 Distribute Fires

30 Devise Scheme of Maneuver

31 Establish Position (Firing or Observation)

32 Estimate Range (LRF)

33 Estimate Range (Unaided Estimation)

34 Estimate Range (Magnifying Optics)

35 Evaluate Position

36 Fire Main Gun

37 Fire Machine Gun

38 Handoff Target

39 Identify Target(s)

40 Issue Fire Command

41 Issue Op Order

42 Lay Main Gun

43 Maintain LOS With Target

44 Maintain Separation Between Vehicles

45 Maintain Visual Contact Between Vehicles

46 Maneuver

47 Mark Target With Tracers

48 Monitor Crew Actions

49 Monitor Platoon Vehicles Positions

50 Monitor Terrain, Aerial Approaches

51 Monitor Terrain, Vehicular Approaches

52 Monitor Threat Warning Displays

53 Obscure Own Visibility (Smoke)

54 Obscure Own Visibility (Fires)

55 Operate Grenade Launcher

56 Operate Hand Held Night Vision Devices

57 Operate Night Sight

58 Operate Range Finder

59 Operate Search Light

60 Overwatch Maneuver

61 Perform Evasive Maneuvers

62 Perform Prepare To Fire Check

63 Prepare Range Card

64 Prepare Report

65 Prepare Weapon (Main Gun)

66 Prepare Weapon (Machine Gun)

67 Priorize Targets

68 Rank Targets

69 Receive Handoff

70 Receive Message, Designation Coordination, Digital

71 Receive Message, Standard, Digital

72 Receive Message (Standard), Radio, Voice

73 Record Target Data

74 Request Fire Support (Direct)

75 Request Fire Support (Indirect, Target)

76 Request Fire Support (Indirect, Suppressive)

77 Request Fire Support (Obscurant)

78 Respond to Equipmant Failure

79 Respond to Threat Warning Signal

80 Search Terrain

81 Select Checkpoint

82 Select Route

83 Select TRP

84 Sense Rounds

85 Set-up Range Finder

86 Supply Suppressive Fire

87 Supervise Crew

88 Survey Target Area, Automatic Search

89 Survey Target Area, Manual Control, Visual Search

90 Survey Waypoint

91 Track Target

92 Transmit Message (Brief), Voice, Brief

93 Transmit Message (Standard), Voice

94 Transmit Report, Digital

95 Use Range Card

AV:'AWL - FUNCTION ANALYSIS WORKSHEET

FUNCTION:_____ OPERATOR:_____ TOTAL TIME:_____

CREW INTERACTION:_____ REMARKS:_____

PERFORMANCE ELEMENTS			WORKLOAD COMPONENTS			DURATION (SECS)	
VERB	OBJECT	SYSTEM	SENSORY	COGNITIVE	PSYCHOMOTOR	DIS	CON

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